SCIENTIFIC AMERICAN

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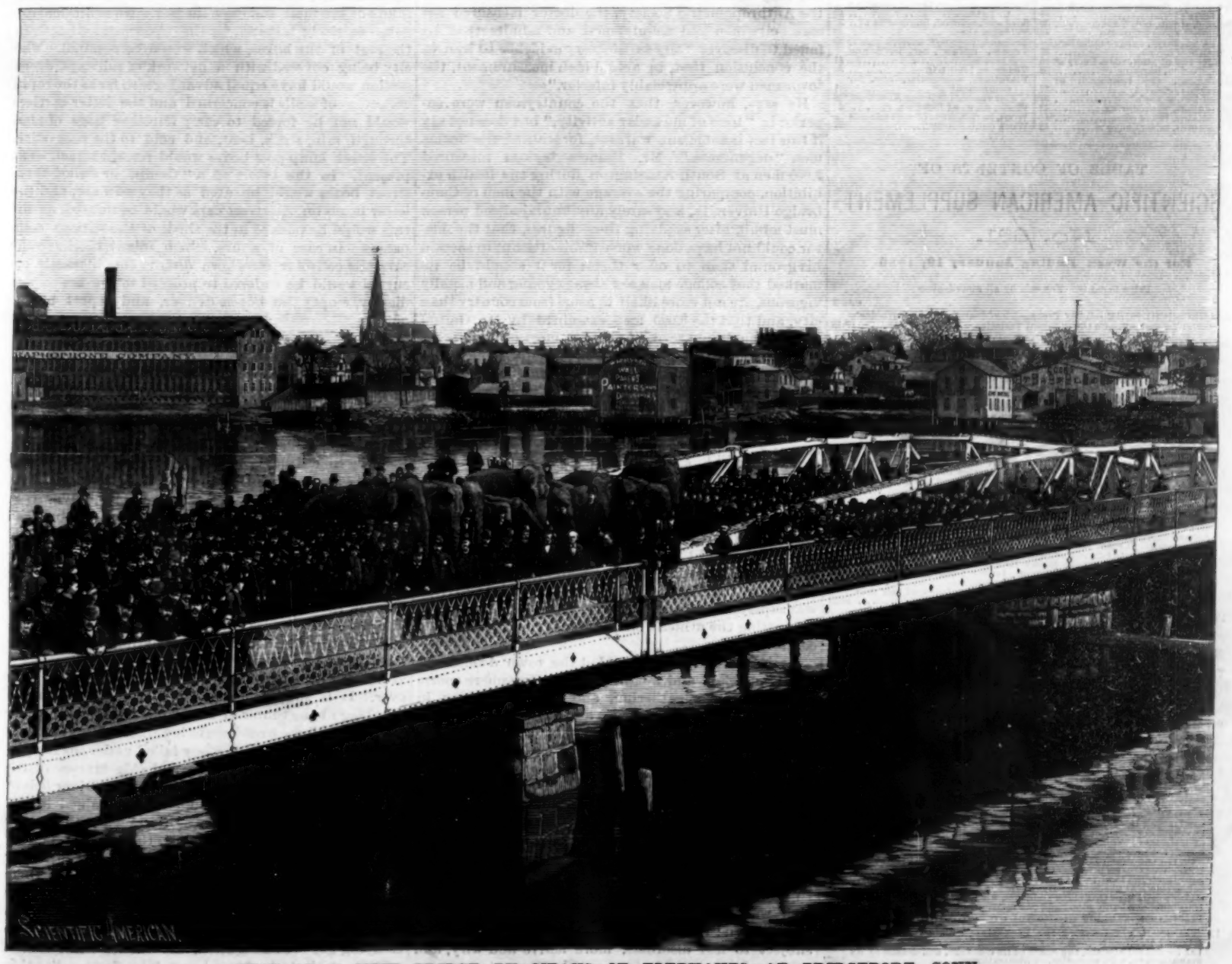
TEST OF A NEW BRIDGE BY MEANS OF ELEPHANTS, AT BRIDGEPORT, CONN.

BY H. C. HOVEY.

In the year 1800, by a special act of the legislature of Connecticut, a part of Stratford was set off as a borough —the first in the State—and in consideration of its harbor being spanned by bridges, it was called "The Borough of Bridgeport." The borough has grown to be a city of about 50,000 inhabitants, with numerous wharves, railroads, mills, factories, and stores; but its original peculiarity continues to be characteristic, so that no one can pass through the place without noticing its bridges; and no one can live there without hearing of Pixley, Benjamin, and Walker, of colonial times; and more recently of Noble, Barnum and Brothwell, as men by whose public spirit they were constructed. There are eight bridges within the city limits; five spanning the Pequonnock river, and three crossing old Mill creek, better known by its three enlargements, Stillman's pond, Pembroke lake and Yellow-mill pond. Each of these bridges has an interesting local history, the particulars of which will not now be given. Those built in colonial days were primitive affairs, of course, though some of them still stand as monuments to the honest workmanship of the fathers. But the Center bridge, and other more recent structures, are characterized by modern improvements. Though originally toll bridges, they are now all owned by the city, and are free.

The Lower bridge was built in 1791, by funds raised by a lottery, and for that reason it was long called the Lottery bridge. It took the place of a ferry that crossed the Pequonnock harbor. It was a wooden structure, and though useful, and having much to do with the growing prosperity of the city, was unsightly enough; being lined for a considerable distance with little shops, and a high parapet the rest of the way obstructing the view. As the western end of this bridge was near the steamboat landing and also near the passenger depot of the Consolidated railroad, while the eastern end was near the large factories of East Bridgeport, and connected with the street leading to Stratford, the amount of travel over it was very great, and increasingly so every year. The structure itself was wearing out and becoming unsafe. The board of public works decided, therefore, to replace it by something more substantial, ample, and elegant. Work was begun on it last April, and it was finished in December, at a total cost of $70,000, not including the approaches, which will cost as much as $20,000 more. There are five large and six small piers, resting on 788 piles, carrying 2,672 tons of granite masonry, 305 tons of iron, 445 tons of asphalt flooring, and other material enough to make the grand total of weight 3,521 tons. Each pile driven is estimated to have a carrying capacity of 10 tons, while the maximum stationary load is only 4½ tons. The draw is to be operated by an electric motor, which will be a novel appliance of electrical power, and will save time and expense in working it. The strength of the entire bridge was peculiarly tested by the road roller, weighing 17 tons, which was worked backward and forward in laying the asphalt roadway. But when all was completed, Mayor Coughlin suggested to Mr. P. T. Barnum that he should test the bridge by sending over it a dozen of his elephants. There was a certain propriety in this, as Mr. Barnum's agent, Mr. C. R. Brothwell, was the special committee from the board of public works for the building of this bridge. Accordingly, in the presence of a large concourse of people, the veteran showman marshaled his elephants and had them driven upon the new bridge. It is well known that an elephant ordinarily approaches a bridge with extreme caution, trying it with his trunk, and by stepping one foot upon it before trusting it with his entire weight. But in this case the whole platoon marched boldly along as if the bridge had been but a continuation of the solid highway. An attempt was made to have them string along singly; but they preferred grouping themselves together like a flock of sheep. Thus they are represented in the accompanying engraving, which is from a photograph by Mr. L. Farini. The aggregate weight of the brutes was about thirty-five tons, or more than double the weight of the road roller. The draw yielded exactly the eighth of an inch under the unusual strain, and settled back to within one-twentieth of an inch of its original position. In estimating the load upon the structure, the weight of the crowd of men ought to be added to that of the elephants. It may safely be predicted that, if the bridge should stand for a century, it would hardly again be subjected to so severe a strain.

ON her trial trip on Friday, January 11, the dynamite cruiser Vesuvius made a wonderful performance, covering 22·947 knots with the wind and tide, and 20·346 knots against the wind and tide, thus making a record of 21·646 knots mean speed. An indicated horse power of 4,295 was developed. A mean of 271·8½ revolutions was attained.



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COUPLING A DYNAMO TO A CAR-AXLE.

The experiment now making on the railway between London and Brighton (London, Brighton, and South-Coast R.R.), to electrically light trains by accumulators charged by a dynamo geared to a wheel-axle, will be watched with much interest because of the convenience and, perhaps, economy of the system. The idea is not, of course, a new one, but one which heretofore has been thought impracticable. In the system now employed on the "specials" of several of our own roads there is found to be much labor and consequently expense in removing the accumulators from the cars for recharging at the dynamo station and returning again; great care must be taken in adjusting the connections, while, in some cases, it is necessary to break the train and side-track the car containing the cells; thus calling for double supervision, for trainmen as well as electrician. There is still another plan for lighting trains electrically, which, in some quarters, is thought to offer better advantages than either of those in use because requiring far less battery power, to wit, establishing the dynamo on the engine; the batteries similarly placed, and only powerful enough to light up when the train stops, which, with "specials," is not often. The eighty lights now employed in the English experiment could readily be generated in this way, and the three tons of cells which now encumber a forward car could be greatly reduced in bulk and removed from the train proper.

ARE TOWNSMEN OR COUNTRYMEN THE HEALTHIEST?

Quite a remarkable paper on this subject was recently read at the British Association meeting at Bath, England, by Dr. G. B. Barron; remarkable because, though the doctor's experience leads him to the assertion that countrymen are the healthiest, the statistics he presents, as will be seen, do little or nothing to sustain him, and, on the broad question, authorities equally reliable have admitted that, class for class, there is no reason for the averment.

Town life, Dr. Barron says, leads to degeneracy because of bad air and bad habits. "Absence of pure air acts upon the animal economy in much the same way as withdrawal of light from plants, the result being pallor and feebleness and lack of constitutional vigor. This effect ramifies in every direction; the tissues of which the human body is composed lose their tenacity and contractile power, and even mental integrity may be more or less affected." In the interests of the Anthropometric Society, the doctor measured 300 men, city men and countrymen, and admits that he failed to discover "any satisfactory evidence to lead to the conclusion that, in actual inch measurement, the townsmen were appreciably inferior."

He says, however, that the countrymen were superior in "tone of muscular activity," but does not say if this fact is sufficient warrant for calling the townsmen "degenerate." Mr. Francis Galton measured 9,000 men at South Kensington during the health exhibition, comparing the average with the men of Cambridge University, and surely any unprejudiced person must admit, after studying these figures, that the doctor could not have done worse in his attempt to sustain his ground than to offer them; for it should be remarked that college men are always young and usually vigorous, are not more likely to come from country than city, and that the 9,000 men examined by Mr. Galton were taken haphazard, of all ages, most of them poor, perhaps unused to proper food, perhaps living under peculiarly unfavorable conditions. Here is the table:

	Height.	Weight.	Breathing.	Pull.	Squeeze.
Cambridge.....	69·9	153·6	254	83	87·5
Kensington.....	67·9	143·0	219	74	85·9

Should such a course of reasoning as this be adopted, it might be affirmed that throat trouble is more prevalent in New England than in New York City, and the proof sought by comparing the statistics of the coast people, notoriously thus afflicted, with the Columbia College boys, or that the "tone of muscular activity" was superior in city-bred men to those of the country by putting the athletic clubs against the dwellers in a country village.

Again, Dr. Barron says: "Let the town dwellers of the same height and weight go to the Grassmere sports or the Braemar gathering, and try conclusions in wrestling or games of prowess and endurance, and the issue will not long hang in doubt." But the men that take part in these sports go in for athletics, while the general public of the city, like the general public of the country, have not the time, even if they have the inclination and opportunity, for such practice. Should, however, the same class of a city engage with those of the country, and surely this is manifestly the only fair test, there is no reason or statistics to indicate that the countrymen would prove the better. In our own country, the fact was notorious during the civil war that city men have more endurance than countrymen; they stood the long marches better, were subject to less disorders, more active and wiry, and recovered more readily from gunshot wounds.

POSTAL STREET CARS.

Mr. Frank Brown, postmaster of Baltimore, Md., makes a very useful suggestion in relation to the utilization of street cars to assist in the rapid collection and delivery of city mail matter. In most of the large European cities they now have pneumatic tubes, by which the quick delivery of special messages is accomplished at a high charge. But a much quicker, cheaper, and more serviceable system for the public might be easily arranged if the street cars were employed. In New York not only might the street cars, but the elevated street railways might be brought into the work, and the city provided with a splendid system of postal delivery and collection. We have heretofore urged this matter upon the attention of the government. We wish some of our senators and representatives in Congress would take up the matter. It is simple and easy of accomplishment, and might be quickly put in operation.

The introduction of such a system, in addition to its great convenience for the public, would put an end to all those disgraceful interruptions of traffic that periodically take place when roughs obstruct the cars, abuse the drivers, and threaten the lives of honest citizens. The street car lines would then be declared mail routes, and no stoppage of travel would be tolerated.

Mr. Brown's suggestion in respect to the city of Baltimore, given in a letter to the New York *Tribune*, is as follows:

It is my intention, if approved by the department and the companies, to place letter boxes on the rear dash of every car in Baltimore City, and to have collectors collect mail from all sections of the city and deposit it in the first car that passes them, the collector to remain in his district and continue collecting and dispatching to the main office during the entire time he is on duty. Under this arrangement the dispatch and delivery of the mail would be greatly facilitated, as many of these letters would arrive at the office to make trains they now miss, and, in addition, the citizens of this city would have full benefit of the special delivery system, as a letter placed in a box on one of these car lines will proceed immediately to the post office (instead of remaining in a street box to be taken up by collector), and on its arrival at the main office be delivered by special messenger.

As the cars pass the nearest point to the post office they would not be called upon to stop, but only to slow up sufficiently to allow the collector to open the box, take out the mail, and close the box. No additional expense would be incurred by the department other than the cost of the boxes, which would be nominal. The city being covered with a network of railways, every section would have equal advantages so far as the rapid collection of mails is concerned, and the letter carriers would not be forced to carry immense bags of mail through rain, slush, heat, and cold to the post office. The street lamp-post boxes would remain intact, as at present. In the event of a "tie-up," or strike, these street boxes would be used as they now are, and the letter boxes on the street cars would be unused, as the cars would be packed in the sheds of the various companies. In case of a fire, which might blockade the cars, the collector on whose district the blockade occurred would be ordered to proceed to the fire immediately, empty the boxes, deliver, and report to the office.

The Tornado.

A tornado which produced disastrous effects in many places on the night of January 9 visited a large region, including portions of New York, Pennsylvania, and New Jersey, and extending up to Canada. Among the more remarkable effects were the destruction of the Reading Silk Mills, in Reading, Pa., the carrying away of the trusses and platform of the Niagara foot bridge, and the explosion of two gas holders in Brooklyn, N. Y. The silk mill fell with some loss of life, but it is believed that two circumstances did much to avert the additional horror of a conflagration. It was lighted by electricity and was heated by steam. The engineer turned off the current as the catastrophe occurred, and an employe of the mill, with great presence of mind, rushed into the engine house and shut off the steam.

The Niagara bridge began oscillating under the effects of the gale, and the last passenger, crossing it at midnight, had all he could do to make his way over. It is supposed that the suspension rods began breaking at the center of the span. The noise of their fracture could be heard sounding like the snapping of twigs, and eventually so many failed under the increasing strain that the whole floor and side trusses of the bridge were carried away and fell into the river below. The towers and suspension cables remained intact. This was late at night. The storm raged with severity in Brooklyn, and about 7:30 P. M. the two gas holders belonging to the Citizens' Gaslight Co., on the corner of Fifth and Smith Streets, exploded. One of them was known to be far from strong, and presumably the pressure was too much. It either tilted or forced in the sides, or possibly caused the coupling to fail. The escaping gas became ignited, and at once nearly half a million cubic feet of gas burst into flames, lighting

up the sky so as to be visible over a large area of the city. Several houses were also blown down in Pittsburg. The center of the storm was north of the great lakes, so that the greatest damage was done on its outskirts.

THE DEEP WELLS OF READING, PA.

The quality of water that may reasonably be expected to be drawn from a selected locality scarcely differs from the geological association or chemical constituency of the rocks underlying the location where a deep well is proposed. The quantity becomes a matter of investigation and judgment from the possibilities of fissures made by the contortions that an otherwise dry rock may have received, but also the condition of the superficial drift, or covering soils, as to their water-bearing capacity, for the waters falling upon the surrounding surface are the real feeders to the deep wells in the tilted and contorted strata of the primitive formations.

Chemically speaking, the silicious sandstones and granitic rocks of the azoic age furnish much the purest water, while the limestones and magnesian rocks of the same age furnish an indifferent supply of hard water, derived from a soft surface water filtered through perhaps many thousand feet of the crushed and contorted strata of the magnesian limestone, becoming by absorption saturated with the carbonates of lime and magnesia.

This feature is made still more objectionable where deep wells are bored beneath cities built upon drift-covered rocks that absorb the sewage from a saturated soil. Such locations become a feeder to the deep waterways beneath.

In the case of unsewered cities having a water works and using the cesspool system, the subsoil becomes saturated with foul water that can only find outlet to the surface wells and to artesian wells within the city limits. This is notably so with the city of Reading, Pa., with 60,000 inhabitants, having a water works and no sewerage, save the surface gutters and cesspools. The lower levels of that city are constantly flooded with excess of surface water, which not only invades the cellars, but actually bubbles up in the streets in many places as natural springs of typhoid-engendering water.

It is a well known fact that malarial and typhoid fevers are habitats of this district. This sparkling fever water from common wells is largely used by the laboring people, and sewerage is neglected as too costly by a parsimonious city government. The water from large surface wells is used by some of the brewers for cooling and washing purposes, and finally discharged into the street gutters.

Artesian borings have penetrated deeply into the folded magnesian limestone (calciferous) of the Potsdam period, lying over and against a friable silicious sandstone, also of the Potsdam series, resting upon the base of the Archean rocks forming the outcrop of the "Reading Hills," the most prominent of which are Mount Penn on the east side and Neversink Mountain on the south side of the city. Elevation 1,140 and 1,000 feet above the sea.

Of these wells we give the details as far as can be learned, and the results.

The artesian well at the Lauer brewery was drilled in the old way (steel drills). It was several years in reaching a depth of 2,060 feet, diameter of bore 4½ inches. Location within the city, one quarter of a mile from the Schuylkill River.

In rock the entire distance, the bottom being nearly 2,000 feet below the bed of the Schuylkill and entirely within the folds of the magnesian limestone, which is tilted at the surface to an angle of 60°. This well was piped and used for awhile, but, not yielding enough water for cooling purposes, was closed, the water not being fit for boiler use, carbonates of lime and magnesia being the incrustating constituent.

The artesian well at the Packerack paper mill was bored with steel drills, and is situated within a few rods from the Schuylkill River, at the foot of the incline from Mount Penn.

The upper section of 350 feet is 14 inches in diameter, the lower section of 650 feet is 8 inches in diameter, making a total depth of 1,000 feet, 980 of which is below the bed of the Schuylkill.

Its whole depth is within the magnesian limestone.

In drilling, water fissures were met at the depths of 200 feet, 300 feet, and between 900 and 1,000 feet. It has a 10 inch pipe reaching down 280 feet, at which point the pump chamber is located. The natural level of the water is near the surface, and yields by pumping a constant flow of 200 gallons per minute, or 288,000 gallons per day of 24 hours. When the pump is urged for a 50 per cent additional supply, the water surface drops to the bottom of the pipe, showing that 400,000 gallons per day is the probable limit of its supply. The quality of the water is excellent for the purpose required, the manufacture of paper, but not suitable for boiler use, as it contains carbonate of lime and magnesia in solution.

The well at Barbey's brewery has a diameter of 6½ inches; bored with a diamond drill to a depth of 1,080 feet, or 1,040 feet below the bed of the Schuylkill, which is distant 240 feet. It is piped with 6 inch casing for 300 feet down, at which point is located a 5 inch pump chamber. The pump has a stroke of 6½ feet, working at a uniform speed during 24 hours of the day, with a daily product of 114,000 gallons.

The water is to all appearance as clear and limpid as the purest spring water, and has a constant temperature of 57° Fah. The large supply of water from this well has been in constant use during the past season for cooling purposes in two of Rankin's ice machines, for barrel washing, and all other uses, except boiler feed and brewing water, which is supplied by the city water works.

At no time has the water surface fallen to the bottom of the pump pipe.

This well is 1½ miles from the base of Mount Penn and about the same distance north from Neversink Mountain, and for its whole depth is within the folds of the magnesian limestone, having thin seams of talcose slate in its lower depths.

The stratum nowhere shows horizontal layers, but is tilted along the line of the bore at all angles from 45° to the vertical, while the drill cores, that were drawn out in lengths up to 6 feet, show contortions of the layers within their own diameter.

The well at the Reading brewery, just finished, is located on the slope of the base of Neversink Mountain, is a 6 inch diamond drill bore and has reached a depth of 1,180 feet.

It is entirely within the magnesian limestone having contorted dips, as shown by the cores of from 40° to 80°.

The bottom of this well must be very near the Potsdam sandstone, which crops out on the side of the mountain within five hundred feet.

At 1,000 feet down, nodules of black flint were found, and at 1,100 feet thin seams of talcose slate were met. The yield of water is limited by the present small pump capacity to 36,000 gallons per day. It is clear and sparkling, but only suitable for cooling in the ammonia ice machines and for washing.

Located, as are these wells, so close to the slope of the sides of Neversink and Penn Mountains, it seems that the drills have nowhere in this vicinity penetrated the sandstone that forms the escarpment of these mountains, and which is supposed to extend beneath the magnesian limestone.

The sandstones of most formations, especially if tilted, are water-bearing rocks, and it is much to be regretted that the enterprising projectors of the Reading wells have not continued the borings through the limestone and tapped the water-bearing sandstone beneath.

G. D. H.

PHOTOGRAPHIC NOTES.

Preservative for Mounting Solutions.—Says S. L. Dobie, in the *British Journal of Photography:* Quinine is a very good preservative for mounting solutions—gum, gelatine or glue, starch, arrowroot, white of egg, etc.

In India it keeps gum from mould, and ants and cockroaches won't touch the gum. Sulphate of quinine or, for choice, neutral sulphate, half a grain and possibly less in some cases, to one ounce of the mounting solution will suffice.

Ready Sensitized Paper.—F. York, in the same journal, states that the following is a practical formula. The object is to add citrate of silver and reduce the quantity of citric acid, and thus facilitate the toning.

Nitrate of silver	2 oz.
Water (distilled)	20 "

Dissolve, and add carbonate of soda one drachm, shake, and add citric acid two and a half drachms. When dissolved, filter.

In silvering float the paper for three minutes and blot off with large sheet of blotting paper.

Mercury and Ferrous Oxalate Intensifier.—As given by J. Perkins, in the *Amateur Photographer:* Bleach the negative in the mercury solution, as is usual, then pour over it the ordinary ferrous oxalate developer diluted with a little water. The blackening proceeds so evenly and gradually that one can stop it at the right moment without any difficulty. The oxalate will intensify several negatives in succession. If the negative when black right through to the back is not dense enough, simply repeat the whole operation of bleaching and blackening again as often as necessary. If the water is very hard, after blackening, soak the plate in an alum bath, which will remove the oxalate of lime, should any be present.

For the benefit of our readers, we would say that the ferrous oxalate developer is made by mixing separate saturated solutions of oxalate of potash and sulphate of iron, both of which can be had at any drug store. Use warm water in dissolving, to insure saturation. Crystals will collect at the bottom when solutions cool. Into eight ounces of the clear oxalate of potash solution pour one ounce of the green sulphate of iron solution, which forms the developer.

Photographing Fireworks.—From a correspondent in Melbourne, Australia, we have received two 4¼×6½ bromide prints from negatives made at a pyrotechnic display. The pictures represent a portion of the display entitled the "Destruction of Pompei," and show the same before and during the eruption.

It was a clear, starlight night, the lens was at full aperture, and remained uncapped for two minutes for each picture. One view, we presume before the destruction, appears to be very much brighter, but lacks the sharpness to be obtained when the lens is stoppered down, or when the plate is backed by a non-reflecting substance. The arrangement of the buildings, with a distant view of the mountain, are, however, very distinctly shown.

Pictures of this kind made on celluloid films or paper films would show much better, since halation by the bright lights would be avoided.

International Photographic Exhibition.—An exhibition of this character is to be held in March of this year at the Crystal Palace, London, England. American exhibitors may send unframed exhibits by mail, and will not be required to pay for wall space. The only condition is that the photographs shall not be returned to the senders. The pictures will be equally eligible with others for awards, unless not desired by the exhibitors.

Mr. Henshaw Russell, Crystal Palace, London, S. E., will correspond with any intending exhibitors.

Trial of an Electric Car Brake.

The Widdifield & Bowman electric car brake was subjected to a series of tests on January 10, a train of fifteen freight cars being used for the trial, which took place upon the Lehigh Valley Railroad between Metuchen and Easton. A drum about six inches in diameter is cast around the axle of a pair of car wheels. The drum is composed of Babbitt metal, with paper disks embedded in it. A small friction wheel is drawn against this by the action of a magnet excited by the electric current. Only an instant is required to do this, as a ratchet bar and pawl are provided to hold the wheel in place when forced against the friction drum. At once the wheel begins to rotate, and in doing so winds a chain around its axle. This draws a larger wheel with of course greatly increased power against the friction drum. It rotates, and winds the brake chain directly around its axle, thus putting on the brake. To release the brakes, another current is sent, which operates a second magnet that unlocks the pawl and ratchet, the friction wheels fall back, and the brakes cease to act upon the periphery of the wheel.

Two storage batteries of ten or twelve cells each are carried, one on the engine and the other in the rear car. With each battery is a switchboard and connections. Thus if the train breaks in the middle, each half is provided with a full brake equipment. An automatic attachment is so arranged that if the train is cut in two by design or accident, the brakes are at once put on. But each switchboard contains a releasing switch, so that if the cut-off occurs in a place where stoppage would be dangerous, the brakes can be released on either or both portions of the train. Attachments are also provided so that brakes can be put on from the roof.

The main battery is kept on open circuit, and is only closed for an instant, when the brakes are to be actuated. One or two cells are kept on closed circuit to operate the automatic part. Thus there is a very slight waste of electricity. In all the trials, which included emergency and service stops, cutting off portions of the train, etc., the mechanism worked perfectly, and it seemed well adapted for its ends. Its cost was stated to be but a small fraction of that of an air brake equipment. The trials were witnessed by a number of representative railroad engineers and journalists.

Eclipse of the Moon.

The eclipse of the moon which occurs on Wednesday, January 16, visible generally over the United States, Europe, Africa, and the Atlantic and Pacific Oceans, has a duration of nearly six hours, during which the obscuration reaches seven-tenths of the lunar diameter.

The moon enters the penumbra at 9 h. 41 m., the shadow at 11 h. 2 m., and reaches the middle at 33 minutes past midnight, ending at 3:25 A. M., January 17. For the vicinity of New York City, this eclipse affords an opportunity for photographic work of amateurs and others of a most satisfactory kind, the slow and undefined motion of the moon giving good images by the use of the improved sensitive plates and short exposures. For Philadelphia and vicinity, the phases are about 5½ minutes earlier, while at Boston they are about 12 minutes later.

Bursting of a French Gun.

On December 12 last, one of the 48 ton breech-loader guns of the French battle ship Amiral Duperre burst, while firing at a target off Toulon. An officer and five men were killed. This gun was one of the finest examples of the built-up system, of which many disastrous failures are on record. Those who brag so much about these guns, and are so ready to denounce cast guns, have considerable still to learn.

Edison Electric Light Consolidation.

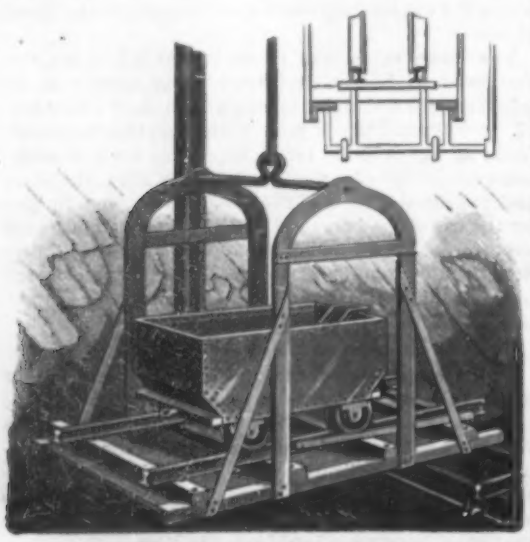
A consolidation has been effected between the various Edison electric light companies, which have heretofore consisted of five in number. These have all been incorporated into a single company, with a large increase of capital. The consolidation has been conducted quietly, and full details have not yet been made public. The articles of incorporation, however, have been recorded at the County Clerk's office of Essex County, N. J., at Newark.

The new organization is to be known as the Edison General Electric Co., and is capitalized at $12,000,000, divided into 120,000 shares at $100 each. The five companies which are the parties of incorporation, and which carried on the entire electric light business under the Edison patents, which are now to pass into the hands of the general company, were the Edison Electric Light Co., the Edison Lamp Co., of Newark, N. J., the Edison Machine Works, Schenectady, N. Y., manufacturers of dynamos, etc., the Edison Electric Light Co., of New York City, and Bergmann & Co., who supplied the minor electrical materials and fixtures. These companies are all represented in the new Board of Incorporators, consisting of E. H. Johnson, ... president of the Edison Electric Light Co., Samuel Insull, manager of the Edison Machine Works, F. R. Upton, vice-president of the Edison Lamp Co., C. Batchelor of the Edison Laboratory, Orange, N. J., and A. O. Tate, secretary of Mr. Edison. It is said by knowing ones that the general factory is to be established at West Orange, N. J., near the factory now used in the manufacture of the phonograph. The general offices will be also, it is presumed, located there. It is claimed that the benefits to be derived from the consolidation of such varied interests will enhance the value of the property, conducted as it will be under one management.

The new company will have control of a great industry well equipped and organized. Formerly the Edison Electric Light Co. has secured the contracts for public and private lighting, built the works, and then sold or leased them on royalty to the local companies. This is to be changed under the new arrangement. The general company will not only establish and equip the local works, but will also, it is stated, attend to running and operating them.

IMPROVED LIFTING CAGE FOR MINES.

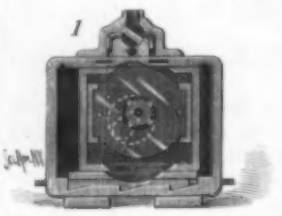
The accompanying illustration shows a lifting cage in which the cars are firmly held in position, when raised or lowered in the mine shaft, and may be easily run on or off the cage at either end. This invention has been patented by Mr. Daniel T. Denton, of Soudan, St. Louis Co., Minn. The rails on the cage platform are each provided, near one end, with a segmental depression, into which fit one pair of the wheels of the car to be lifted by the cage, and at the sides of the rails are pivoted arms, preferably connected with each other at their outer ends by a transverse bar passing under the rails. As the car is moved onto the cage one set of wheels drop into the depressions, holding the car firmly in place while it is being moved up or down the shaft. When the car reaches either the surface or bottom of the shaft, the pivoted arms, engaging the tread of the wheels, are raised, lifting the wheels out of the depressions and in line with the tops of the rails, so that the car may be readily run off the cage in the usual way. The raising of these pivoted arms is effected by means of a shaft mounted in suitable bearings at the top or bottom of the main shaft, this shaft having two arms engaging the platform of the cage as it comes to rest, and two longer arms or prongs adapted to engage the transverse bar connecting the arms pivoted at the sides of the rails under the wheel treads, as shown in the small sectional view, whereby the wheels are lifted out of the depressions. A lever, weight, or other device may be employed for operating the latter shaft, so that it will assume the position necessary for raising the pivoted arms automatically whenever necessary.

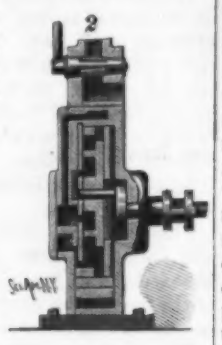


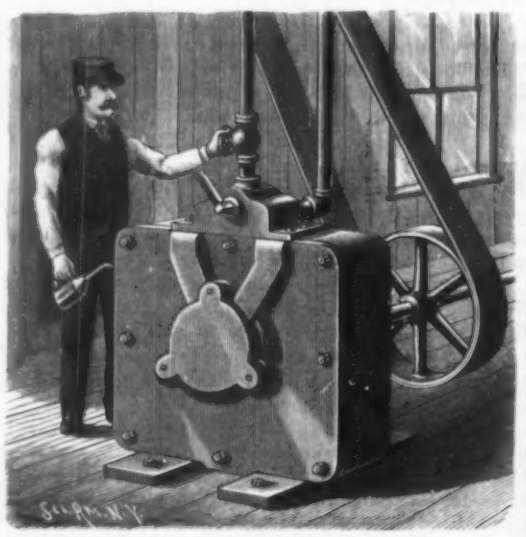
DENTON'S LIFTING CAGE FOR MINES.

IMPROVED DOUBLE-RECIPROCATING ENGINE.

The accompanying illustrations represent an improved double-reciprocating square piston engine, Fig. 1 being a front view, with the cover removed, and the steam chest in section, and Fig. 2 being a sectional view. It has been patented by Mr. William F. Dake, of Grand Haven, Mich., and is an improvement on a former patented invention of the same inventor. The engine is within a casing, in which a rectangular piston is held to move backward and forward horizontally. This piston has a chamber in which an inner piston is mounted to slide vertically, the inner piston being mounted in its middle on a crank pin projecting through a slot in the back plate of the outer piston, the crank pin being secured to a crank disk on the inner end of the main driving shaft. The steam chest on top of the casing has a four-way valve, into which leads the steam inlet pipe, this valve also connecting with the exhaust pipe, and being adapted to connect the inlet pipe and the exhaust pipe with either of two ports formed in the steam chest, and leading to ports in the casing connecting with channels formed in the outside of the cover of the casing. One of these channels leads to a central aperture in the middle of the cover, and opening at the inside against the face of the inner piston, while the other channel leads to an annular opening on the inside of the cover opening on the face of the inner piston, the arrangement being such that either of the channels may serve as an inlet for live steam, according to the direction the engine is to be run, by simply turning the four-way valve, the other channel then serving as the exhaust.







DAKE'S DOUBLE-RECIPROCATING ENGINE.

The central opening and the annular opening connect alternately with four ports in a circle in the inner piston, the passage of the steam through these ports communicating a reciprocating horizontal motion to the outer piston, the inner piston moving up and down, and communicating rotary motion to the main shaft, by means of the crank pin and crank disk, the movement of the inner piston causing the inner ports to register with the central opening, while the exhaust is through the annular opening. The wear of the outer piston is taken up by plates, on the under side of one of which are inclines sliding on corresponding inclines in the bottom of the casing, whereby the pressure of the bottom plate upon the piston can be readily adjusted by screws. These engines are said to have given excellent satisfaction during two years' practical use, proving durable and not liable to get out of repair.

For further information relative thereto address the Dake Engine Manufacturing Company, Grand Haven, Mich.

Berlin Wool a Preventive of Sore Throats.

According to Mr. H. V. Knaggs (*Archives of Pediatrics*), a few threads of Berlin wool placed round the neck and worn continuously are an efficient preventive against these uncommoding complaints, which many persons are so prone to catch on exposure to cold. From ten to twenty threads are enough for the purpose. They should only be removed for making ablutions, and should be left off gradually by discarding daily one thread at a time. The remedy probably acts by keeping up a belt of skin action, thus acting mildly and continuously as a slight counter-irritant.

Thread Spools.

Among the peculiar industries which flourish in western Maine is the making of thread spools. They are cut from smooth, white birch timber—a wood which works easily—by various kinds of improved machines. There are numerous mills throughout the lumbering region, where the birch is sawed into strips about four feet long and from one to two inches in width and thickness. These strips then go to the spool factories, to be converted into spools. The processes they are put through are numerous, and one of them, the method of polishing them, is quite interesting. A barrel is filled nearly full of them and then revolved by means of machinery and belting until the spools are worn smooth by rubbing one against another. Spool manufacturing is the most important industry in several of the villages of Oxford County, and will doubtless continue so until the supply of white birch timber is exhausted. The manufacture of shoe pegs is another peculiar Maine industry, though shared in to some extent by other New England States. These are cut from maple and white birch by machinery, and are worth at the factory from thirty-five to ninety-five cents a bushel. The compressing of sawdust is also a flourishing business in Bangor in that State. There is a firm there styling itself a "compress company," who convert sawdust and shavings into solid bales by compression, which finds ready sale in the large Eastern cities. —*Timberman.*

Coffee Deceptions.

Staining Coffee Berries.—J. Konig, *Zeitschr. f. angew Chemie, No.* 22.—Berries are often roasted with addition of roasting sirup, which unsavory article the author found to consist of: Water, 26·21; fermentable sugar (dextro-glucose), 45·80; unfermentable bodies and dextrin, 37·45; ash, 0·54. Its use is said to be in preserving for a long time the delicate aroma of the berries; but, according to the author, it really constitutes a fraud. Not only does it make the coffee decoction look stronger, but it enables the roasted berries to hold about 7 per cent more water than they otherwise would.

Artificial Coffee Berries.—J. Konig, *Zeitschr. f. angew Chemie, No.* 22.—A sample submitted to the author for analysis looked very much like the real article, only the berries had all precisely the same shape, which is not the case with the genuine product. The result of the analysis was as follows: Moisture, 5·14; nitrogenous matter, 10·75; fat, 2·19; non-nitrogenous matter, 76·76; woody fiber, 3·96; matters soluble in water, 29·88; ash, 1·20. Microscope revealed wheat starch. The berries, therefore, consisted, no doubt, of roasted wheat flour dough of low quality. They are eagerly brought by retailers, and afterward mixed to an extent of sometimes 50 per cent with genuine berries. —*The Analyst.*

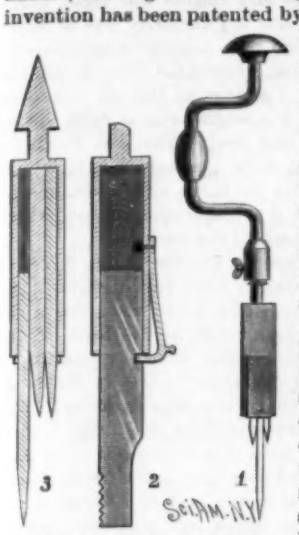
A FOOT-SHIELD FOR PIANOS, ETC.

The illustration herewith represents a simple device for protecting pianos, organs, etc., from being scratched or marred by the feet of the operator, when turning in the seat to face the instrument or leave it, or when the feet are removed from the pedals for any cause while the operator remains seated at the instrument. It has been patented by Mr. M. R. Brinkman, of No. 928 Chapel Street, New Haven, Conn. A shoe, shown in the small figure, essentially U-shaped in cross-section, is screwed or otherwise attached to the bottom of the front casing of the instrument, the outer wall of the shoe having apertures through which the shield may be made fast therein, and upward ornamental projections which may themselves serve to hold the shield in place. The shield is ordinarily of wood, padded and covered with silk, plush, or equivalent material, with the padding extending over its edges, to protect that portion of the instrument against which the shield may bear. This shield may be attached to the instrument without leaving any material defacement, should the device for any purpose be removed.

BRINKMAN'S FOOT-SHIELD FOR PIANOS ETC.

AN IMPROVED SCREW DRIVER.

The accompanying illustration shows a form of screw driver in which a series of notched bits is held extended from a socket or handle in position for use by means of a spring catch, Fig. 1 showing the device with a brace handle, and Figs. 2 and 3 being sectional views. This invention has been patented by Mr. Charles B. Morgan, of Telluride, Col. The shank of the casing is secured in the handle by means of a set screw, the ends of the bits projecting out of the casing, and being preferably formed with notches on one side by means of which a bit may be drawn up and secured in position for work, one means of holding the bits in position for work being a spring catch, on the side opposite the notches, engaging a notch on the side of the bit. By means of this device one size of screw driver can be readily changed for another, by simply releasing one bit and dropping it into the casing and drawing forth another bit and securing it in place.



MORGAN'S SCREW DRIVER.

IMPROVED PULSATORY WOOL WASHING MACHINE.

We give herewith an illustration of a new device for washing wool from which results have been obtained so important and valuable as to make the invention almost revolutionary in this branch of industry.

The washing of wool, as ordinarily conducted, is done in open basins, containing the alkaline solution, in which the fibers are subjected to harsh mechanical treatment with metallic beaters. It is a lengthy process, involving much time, considerable expense for labor and power, and a high temperature; moreover, the fibers are more or less dissolved, weakened, broken, and impaired. The cost of the plant for washing is also large, and forms a serious item in providing capital for business. The aggregate losses of wool in this country, under the present defective methods of washing, have been estimated at twelve millions of pounds per annum.

By the new system now to be described, all the foregoing losses and difficulties are obviated, and a more rapid, economical, and superior style of apparatus is substituted, from which remarkable practical results are now being obtained.

We will briefly describe the new device, premising, however, that its size, form, and capacity may be varied in accordance with the requirements. The wool is fed in at G, and there meets a current of the alkaline washing solution from pipe, C, by which the wool is carried into the tilting box, H, which tilts when its contents exceed the power of weight, I, and the wool and solution then drop into and pass along through tube, J. A pulsatory movement and action is thus imparted to the wool, which has a tendency to cause the fibers alternately to open and close, bringing the solution thoroughly into contact with the fibers and washing the same in the most effective manner. As the wool and solution thus intermittently advance through the tube, the cleansed wool is discharged at O into the receptacle, P, while the accumulated solution is drained off at K and passes by pipe, N, to tank, A, whence it is forced by pump, B, back into pipe, C, to be used again as before described. Besides the solution that goes through the tilting box before mentioned, a gentle and constant stream thereof is made to pass through the apparatus by means of side pipe, D.

Such is the effectiveness, simplicity, and rapidity of the operation that a single machine, of small size, costing only a few hundred dollars, and using a weak solution, will easily treat 60,000 lb. of wool per day; while an apparatus of ten times that capacity could be readily made at but little extra cost.

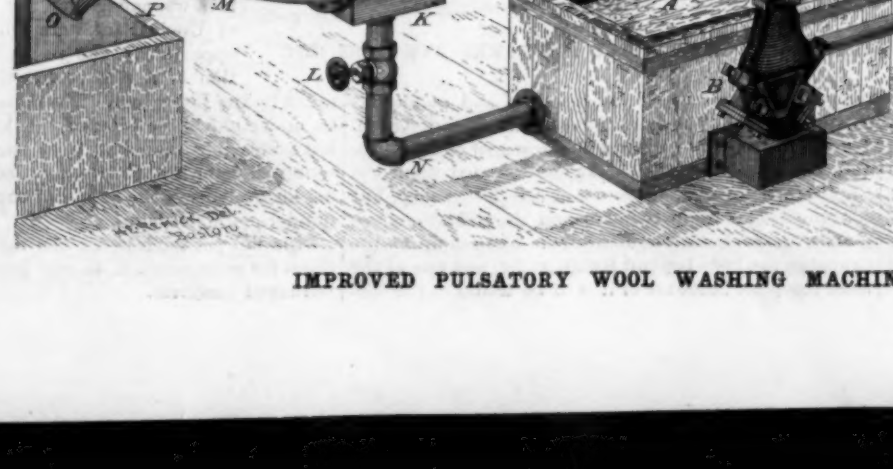
In conclusion we may mention among other advantages of this pulsatory system the following:

The intermittent supply is the only principle by which the flume becomes practicable. Its operation cleanses the flume from every particle of deposit.

It is adjustable, so that any length of treatment that may be desired can be obtained. After adjustment, it is perfectly regular, delivering each feeding like clockwork. The intervals of delivery exactly equal the intervals of supply. The wool fibers are not mechanically broken, are not weakened, are not dissolved. In fact, there is little or no waste.

The results of using this process show by actual tests a gain of from three to five and a half pounds of clean wool from every hundred pounds of grease wool, over wool treated in open basins, and the gain in quality even exceeds the gain in quantity.

Further information may be had by addressing the International Wool Improving Co., 624 Atlantic Avenue, Boston, Mass.



IMPROVED PULSATORY WOOL WASHING MACHINE.

A NEW SCREW CUTTING DIE.

The ordinary solid die for cutting screws is slotted in one side to render it more or less adjustable, so as to vary the size of the screw within certain limits. These dies in the process of manufacture are extremely liable to check in the thinner parts forming the rim of the die, so that they are liable to break whenever any adjustment of the die is attempted; or if the die escapes this ordeal, the thin part, being nearly if not quite as hard as the cutting edges, soon cracks and renders it worthless.

Fig. 1.
BRION'S SCREW CUTTING DIE.

Mr. Adolph E. Brion, the inventor of the improved die shown in the engraving, has overcome this difficulty by making the die of a steel disk provided with a periphery of soft iron, which readily bends enough to allow of any desired adjustment of the die. When the die is once adjusted, it stays in that position. This improvement is the subject of a recent patent.

Fig. 2.—SCREW PLATE WITH BRION'S DIE.

Peter A. Frasse & Co., of 95 Fulton Street, New York City, will manufacture dies under this patent.

Substances Liable to Spontaneous Combustion.

Cotton-seed oil will take fire even when mixed with 25 per cent of petroleum oil, but 10 per cent of mineral oil mixed with 10 per cent of animal or vegetable oil will go far to prevent combustion.

Olive oil is combustible, and mixed with rags, hay, or sawdust will produce spontaneous combustion.

Coal dust, flour dust, starch, flour (especially rye flour), are all explosive when mixed with certain proportions of air.

New starch is highly explosive in its comminuted state, also sawdust in a very fine state, when confined in a close chute and water directed on it. Sawdust should never be used in oil shops or warehouses to collect drippings or leakages from casks.

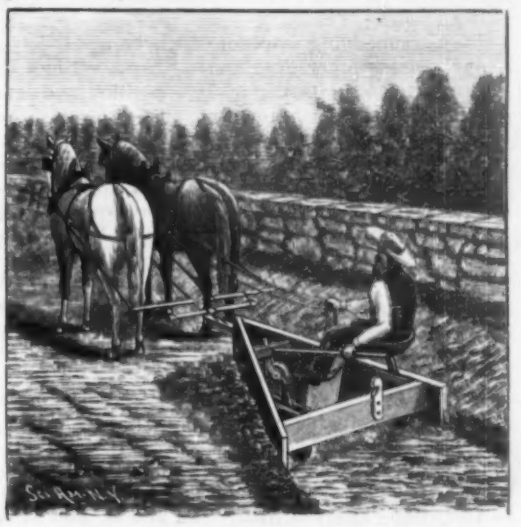
Dry vegetable or animal oil inevitably takes fire when saturating cotton waste at 180° F. Spontaneous combustion occurs most quickly when the cotton is soaked with its own weight of oil. The addition of 40 per cent of mineral oil (density 0·890) of great viscosity, and emitting no inflammable vapors, even in contact with an ignited body at any point below 338° F., is sufficient to prevent spontaneous combustion, and the addition of 20 per cent of the same mineral oil doubles time necessary to produce spontaneous combustion.

Patent driers from leakage into sawdust, etc., oily waste of any kind, or waste cloths of silk or cotton, saturated with oil, varnish, turpentine. Greasy rags from butter, and greasy ham bags. Bituminous coal in large heaps, refuse heaps of pit coal, hastened by wet, and especially when pyrites are present in the coal; the larger the heaps, the more liable.

Lampblack, when slightly oily and damp, with linseed oil especially. Timber dried by steam pipes, or hot water or hot air heating apparatus, owing to fine iron dust being thrown off; in close wood casings or boxings round the pipes, from the mere expansion and contraction of the pipes. —*American Miller.*

AN IMPROVED ROAD GRADER AND DITCHER.

The accompanying illustration represents a grading and ditching machine of simple construction, designed



PERRY'S ROAD GRADER AND DITCHER.

to be light of draft, and which may be conveniently drawn along the road without operating upon it. It has been patented by Mr. Marlow F. Perry, of West Oneonta, N. Y. The body of the machine is triangular, and to the outer face of the side beams metal blades are secured, extending below the base of the frame, to act as knives or scrapers, the two blades uniting at the front to form a sharp vertical cutting edge. A draft-bar, pivoted on a pin, is projected through an opening in one side beam, the draft-bar being guided in its vertical movement by a bracket. Near the front of the frame a transverse rock-shaft is journaled, in which is pivoted a downwardly extending caster wheel, the rock-shaft being manipulated by a rearwardly extending lever adapted to be engaged by a rack on the rear cross-beam. Near the rear end of the frame, on each side, are forwardly swinging pivoted vertical levers, the lower ends of which are curved rearwardly, and each provided with a wheel. These levers are adapted to reciprocate in brackets, provided with teeth, whereby the levers may be adjusted to bring the wheels in contact with or elevate them from the ground. A platform is secured centrally and diagonally of the frame, to which the driver's seat is attached, in such position that he can readily manipulate the levers—to let the frame down upon the ground, so that its blades will operate as it is drawn along, or to lift the frame so that it will rest upon the rollers, to be conveniently moved from place to place.

Fast Railroading.

What is said to be the fastest time ever made between Portland and Chicago was that of a special train chartered by Geo. W. Markle, a prominent Portland banker, to convey him to his father's deathbed. The train left Portland, Oregon, Tuesday at 8 P. M., and reached Chicago at 11 A. M. Friday, having made the run of 2,310 miles in sixty-three hours, an average of thirty-seven miles an hour. Between Portland and Huntington, a distance of 404 miles, the run was made in less than ten hours. The average speed between Cheyenne and Omaha was 49 miles per hour, and between Portland and Cheyenne 48 miles. The train cost Mr. Markle $2,000, or $32 an hour.

THE BARTLETT PROJECT FOR A WATER SUPPLY FOR LOWER NEW YORK.

This project contemplates bringing 50,000,000 gallons per day of pure water from the Passaic watershed to the lower or business portion of New York, and delivering it under a head of 300 feet. As already noted in this journal, this water will be sold to the city for $75 per million gallons, as stated in the formal proposition made to the Sinking Fund Commissioners on November 30.

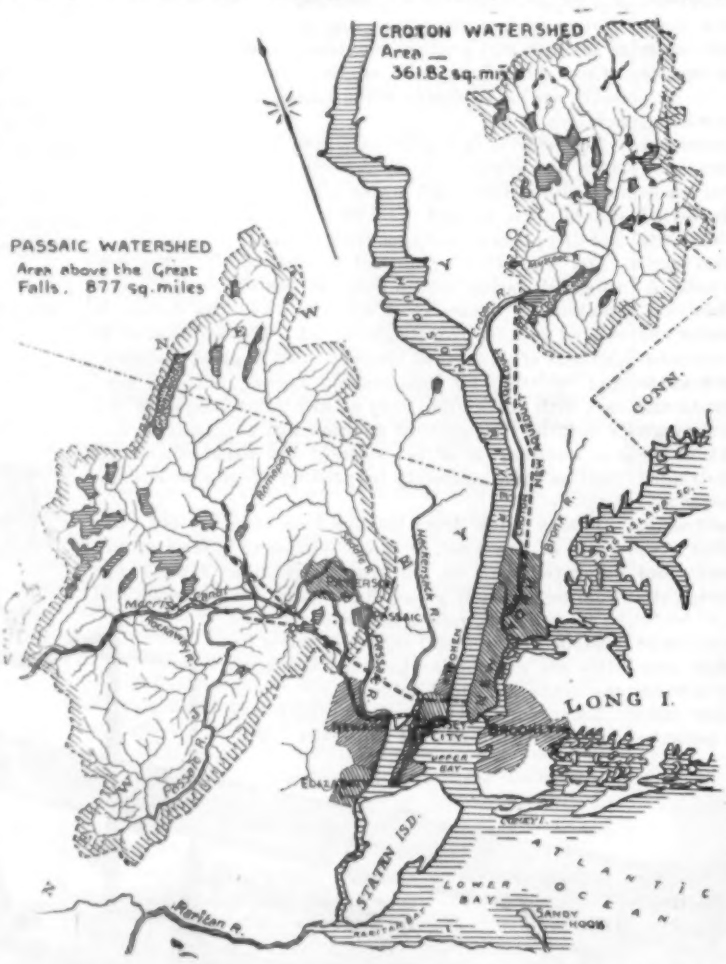
The accompanying map, for which we are indebted to our contemporary, *Engineering News*, outlines the scheme, and contrasts the relative position and areas of the Passaic and Croton watersheds, showing that the former is about two and a half times as large as the present source of supply, and that the storage center is much nearer to the City Hall. But while the Passaic is the largest, all of its water, above the Great Falls, is the property of the Society for Establishing Useful Manufactures, at Paterson. This right is well established by judicial authority and by nearly 100 years' uninterrupted use, and the water above that point cannot be diverted for a water supply without the consent of the society, or by the exercise of the right of eminent domain.

The syndicate then proceeded to locate and secure by purchase the available sites for storage reservoirs in the Passaic watershed. Among the property thus obtained, the pamphlet issued by Mr. Bartlett mentions the following: Lake Macopin, 2 by ⅛ mile in area; 50 feet to 60 feet deep; sandy bottom, clean shores, and at an elevation of 1,000 feet above tide; it is 40 miles from the city, and has a daily output of 9,000,000 gallons of the purest water. Dunker Pond now has 25 acres of water surface; but a dam 40 feet high would create a reservoir 4 miles long and ⅛ to ¾ mile wide, with 40 feet of water and an outflow of 16,000,000 gallons per day. Split Rock Lake contains about 250 acres in surface, and has a depth of 10 to 20 feet of pure water. The Montville reservoir is another secured, along with reservoir sites in other localities.

All of the above are gathering or feeding reservoirs, intended to supply water to the natural channel in the dry season. Distributing reservoirs were the next necessity, and the sites for two of these were purchased. The first is in the Garret Mountain, a spur of the Orange range, near Paterson. Here a dam would form a reservoir of about 300 acres, with 40 feet of water, at an elevation of 400 feet above tide, and distant only 15 miles from lower New York. South of Garret Mountain, and contiguous to it, lies the Great Notch, forming a natural site for a storage basin, with an elevation of 300 feet above tide. The first of these was set aside for the supply of New York, and the lower reservoir will afford an ample head for the cities of Montclair, Newark, Jersey City, and all surrounding towns if they so elect.

As this source of water supply, as far as New York is concerned, is in a neighboring State, with the broad and deep Hudson River intervening, the only serious engineering problem connected with the scheme is the crossing of this river. A number of plans were considered and rejected, and the final decision was arrived at to tunnel the river and carry the water through this tunnel in pipes. Mr. Bartlett and his associates practically tested the material under the river bed by furnishing the means for resuming work on the Hudson River tunnel. They had this tunnel pumped out, and actually built sufficient new tunnel to convince them that its completion was feasible. The expressed intention is to finish this tunnel for water carriage, and to afford facilities for telegraph and telephone wires. Its intended use as a railway tunnel would be abandoned.

To utilize water under 300 feet head, the Sinking Fund Commissioners would be called upon to exercise the right they now legally have to create an independent system of pipes for fire service exclusively. And for domestic or office purposes the pressure could be reduced to 40 or 50 pounds per square inch and the water used in the present pipe system.



PROPOSED PASSAIC WATER SUPPLY FOR LOWER NEW YORK, ETC.

Work Deliberately.

There are some things that must be done in a hurry, or not at all. Catching a flea is one of the best examples *apropos* to this. But as a rule, it is safe to say, the man or woman who works deliberately accomplishes the most. The deliberate worker is the thoughtful worker, with whom the habit of system has become second nature. Any one may cultivate it who will take the trouble to try; and the most unsystematic, spasmodic worker will realize with amazement how easy it is to get through an allotted task in half the time it formerly required, by planning it all out before entering the office, workshop, or kitchen.

The hurried worker is the one who fancies he is an uncommonly busy man. True, he is; so is the man who tries to bale out a leaky boat with a crownless hat; and in proportion to the energy expended, very often, the one accomplishes about as much as the other. The busiest men we have known were those who never seemed to be in a hurry, and they accomplished more in a given time, and were less worn out when their work was done, than many who accomplished half as much, and almost ruptured themselves in doing it.

Think about your work before beginning it, then go at it deliberately. It will save wear and tear of nerve and muscle, you will accomplish more, and what you do will be better done.—*The Manufacturer and Builder.*

AN IMPROVED CAN OPENER.

A simple and effective tool for use in cutting round pipe sections, or for opening cans, is shown herewith, and has been patented by Mr. David H. King, of No. 255 Fourth Avenue, New York City. To the head of a suitable handle is secured a plate formed with a slot on its under side, the inner edge of the outer section formed by the slot being sharpened to constitute a cutting edge. At the bottom of the rear end of the blade is a laterally projecting fixed fulcrum piece, making a secure rest for the thumb of the operator, and the forward end of the plate is a pointed blade or dagger, adapted to puncture the can or pipe for the insertion of the cutting blade. The puncturing dagger may also form a rest for the thumb of the operator, and, to prevent the thumb from slipping off, the tool is formed with serrations on its shoulder, this feature being especially desirable in operating on round pipe sections.

KING'S CAN OPENER.

An Old Yankee Steam Engine.

It has been claimed that to Rhode Island belongs the honor of using the first practical stationary steam engine in the United States. Without attempting to vouch for the historical accuracy of the statement, it is sufficient to know that the engine was at work in the town of Cranston more than a hundred years ago, and that, although of crude construction and ponderous movement, it did the work for which it was designed. The engine was built by Joseph Brown, of Providence, and cost upward of £1,000. It was founded upon the English type of engine known as the Newcomen, but contained some improvements and simplifications original with the builder. The engine was set up at the Cranston ore beds beyond Knightsville, and one of the most complete accounts of it is to be found in the biography and diary of Manasseh Cutler, LL.D., Ipswich, Mass. Dr. Cutler appears to have learned of this engine, and taken a chaise journey to New York to visit it. In the diary, under date June 27, 1787, he thus describes the mechanism:

To go to the furnace and engine was eight miles, nearly, out of my way, but my curiosity was so much excited by the description of so singular a scheme—the only one in America—that I could not deny myself the pleasure of viewing it. I arrived at the ore beds (iron ore) at twelve o'clock. The engine was at work raising water from a well 80 feet deep. The iron flue is 2½ feet wide by 6 feet long, with a square hearth at the mouth, secured from fire by large, thick iron plates. On the back part of the flue is a winding funnel, which passes into a chimney back of the building.

Above the flue is placed a wooden boiler, 6 feet in diameter, which is constantly kept full of water when the engine is in motion. The boiler rises above the first story of the building, much in the form of the large cisterns used in distilleries, where it receives, at the top, the condensing cylinder, 2½ feet in diameter, and made of plated iron. From this cylinder a large worm passes, with many windings, down the boiler. The valve that passes into this cylinder is more than two feet in diameter, and rises and descends by means of an iron rod made fast to one end of a large beam. Around the top of the boiler are numerous leaden pipes—some connected with the condenser and some not—furnished with stop cocks for admitting and excluding air or water, as necessary in working the machine; but they are too numerous and complicated to admit of any description from a mere view of the machine. A large reservoir of water is placed in the third loft of the house, constantly affording water to the works below, and is constantly supplied with a pump for the purpose, by the working of the machine.

The large beam is a massive piece of timber, near 4 feet in diameter and 20 feet long, being two very large oak timbers nicely forged together. It moves on a large iron bolt in the center, like the beam of scales, and has two arching timbers at each end forming the segments of a circle, along which two chains of a prodigious size play as the beam moves. One of these chains leads to a piston or valve of the condenser, and the other at the opposite end to the pumps in the well. There are four cold-water pipes, one feeding pipe, and one venting pipe. By the same motion of the beam which raises the water out of the well, all these pipes open or close by means of stop cocks and valves as the design of them requires. There are two large pumps in the well, which is 80 feet deep and 23 feet wide. The sides of the well are supported by large timbers laid horizontal so as to make the form of the well quintangular, and the ends of the timbers are let into one another. The engine raises seven hogsheads of water a minute, and the flue consumes two cords of wood in twenty-four hours.

The immense weight of the beam, the cast iron wheels, large chains, and other weighty parts of the works, occasion a most tremendous noise and trembling of the large building in which it is erected, when the machinery is in motion. By the sides of the well from which the water is drawn are two other wells, 70 feet deep. These are sunk down in the bed of ore, and in these are the workmen, ten or twelve in number, digging ore. The ore is raised in large buckets, which hold about one ton weight, let down and drawn up by large chains, carried from the well to a large capstan which is constantly turned by an ox. As one bucket arises, another goes down. These wells are kept dry by the water continually drawing off into the well where the pumps are fixed, and the pumps keep the water below the height where the men work.—*Providence Journal.*

Scientific Logs.

If a man had been requested to tow a lot of logs out to sea and set them adrift in mid-ocean in order to enable the government hydrostatic office to take notes on the directions of various ocean currents, as shown by the drifting logs, he would have asked to be well paid for the service. But when the Leary raft went to pieces the idea was carried out, and the scientific agents of Uncle Sam were not slow to see their opportunity, the result being the publication of a pilot chart showing the courses taken by the Leary logs. The department had wanted to undertake something of the kind for some time, but no feasible plan had been suggested. But as no serious disaster has occurred on account of the floating logs, science is the gainer at the expense of the raft builders.—*Lumberman.*

It is not yet too late for the raft man to present a claim for compensation to our generous and surplus-burdened Congress.

Correspondence.

The Albert Hall Organ.

To the Editor of the Scientific American:

There appears in your issue of Dec. 29, 1888, an extract from *La Science en Famille*, in which the total number of registers in the Albert Hall organ is given as 100, and the Riga organ as 125. The former really contains 132 registers, of which 116 are speaking stops, but of the 125 allotted to the Riga organ, there are only 105 speaking stops.

NORMAN H. SCHNEIDER,
late organist, London, Eng.

Flatbush, N. Y., January, 1889.

Capacity of the Simple Plunge Battery.

To the Editor of the Scientific American:

Will you permit me to say, through your columns, in answer to numerous inquiries I observe in your paper, that, in my opinion, you overestimate the number of cells of "simple plunge battery" necessary to run motor illustrated and described in SUPPLEMENT No. 641. The writer has constructed a motor of the size mentioned, and on the same general principle, and has run a sewing machine with it, sewing through twenty-four thicknesses of heavy drilling, and using only six cells of simple plunge battery, with double carbons and single zincs, each 6"×1⅝"×¼", size of jars one pint. He has also driven a fan, 16½ inch diameter, six blades, at a speed of 900 revolutions per minute for over half an hour, using the same battery and same motor, speed taken by regular speed counter every fifteen minutes. The fan ran for over an hour before battery was exhausted, running at from 500 to 300 revolutions per minute during the last fifteen minutes.

The motor ran the sewing machine for over half an hour before it began to slow up. Speed not taken, but running as fast as one would wish for sewing comfortably.

The only objection to use of such small battery appears to be the rapidity with which the solution is exhausted, owing to its small quantity. The plates appear to be large enough to give the number of amperes necessary, and the number of jars give the volts.

Cost of six pints of solution about 25 cents.

C. D. PARKHURST,
Lieut., Fourth Artillery.

Fort Snelling, Minn.

[It is a great object always to allow for enough battery power. Your experience shows this, as the battery under the work you give it to do so quickly ran down. The voltage of a single fluid battery rapidly decreases, and this diminution of force has to be allowed for.—ED.]

Electro-Physiology.

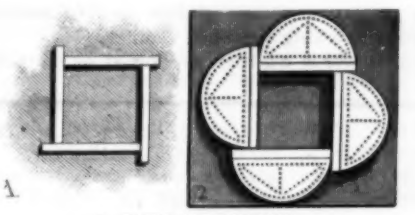
At Owens College, Manchester, Professor Stirling lately delivered a lecture on the electrical properties of the tissues, but especially of those composing the nervous system. There are about fifty species of fishes which are known to have specially modified organs for the generation and discharge of electricity. These organs when at rest do not discharge their electricity; but if the animal be irritated, electrical shocks are discharged, which in some fishes are very powerful indeed. By means of electrical discharges these animals not only stun their prey, but they ward off the attacks of their enemies. The animal may discharge its batteries voluntarily, but after having done so for a considerable number of times the electrical organs become fatigued, just as muscles after severe exercise are fatigued. At first sight it might seem remarkable that certain animals are provided with structures which evolve powerful discharges of electricity. This, however, is not by any means the most remarkable fact. When we know that the whole of the body of the animal is traversed by the electrical current at the moment it is discharged, it does seem far more wonderful that the tissues of the animal itself are not thereby affected; not even a muscle is caused to contract, although the discharge must necessarily traverse the nervous system as well as the muscles. The animals, therefore, have an immunity from the effects of their own shocks. Darwin admitted that the presence of these organs in a limited number of fishes was a fact not easily explained on the evolution hypothesis. Recent researches, however, have shown that the electrical organs are really modified muscular organs, or the terminations of nervous structures in muscles. This fact greatly simplifies the problem. Muscles and nerve, however, evolve electricity in the living condition; and a variation of the electrical conditions of a muscle, a nerve, or even of protoplasm generally is one of the best signs of the vital activity of these structures. With Galvani's experiments on the twitchings of the limbs of frogs, there commenced the investigation of electrical phenomena, which have led to such splendid results, not only in physiology, but to the development of new means of producing electricity and its numerous applications in the arts. The lecturer demonstrated the classical experiments of Galvani, Volta, Noboli, Du Bois Reymond, and others, showing historically on what lines our present knowledge of animal electricity had been reached.

Results of Good Patents.

W. P. Proctor, vice-president of the Singer Sewing Machine Company, lives at the Fifth Avenue Hotel, and has the best horses and carriages in the city, but never rides. His own exercise is walking, and the carriages are for his family. He was a mechanic when he first met Singer. They went into partnership to make rock drills on Cherry Street. The drills worked with a hand ratchet. Their factory blew up, and Singer walked all the way to Boston in the hope of interesting Boston people to start a factory there. While in Boston he was asked to go around the corner to see a wonder—it was a sewing machine. He came back to New York and said he could make a better sewing machine than the one he saw. They raked together $50, and the machine was made, and in thirty-five years this $50 of capital grew to be $30,000,000. Proctor married Singer's daughter, and is probably worth $25,000,000. He owns a third of the stock of the Singer company. It is amusing to hear him tell at times how, in the early days of his sewing machine experience, he and Singer used to dream of the time when they could make 2,000 machines a year, which they were certain would yield them a fortune. To-day they make 2,000 a day.—*Daily Paper.*

A BOY'S INVENTION.

Dr. L. K. Klemm, of the Technical School, of Cincinnati, Ohio, tells, in the *Journal of Education*, of a rather interesting instance of the inventive genius of a boy which had been stimulated and developed by technical education. At a tile manufactory near that city, it was the practice to have different sized steel forms for each size of tile. Whenever it was necessary to make a new size of tile, a new form was necessary, the cost of which was $18.50. In the course of a year, this item became quite a heavy expense. A boy, whose name it is unnecessary to mention, was passing through the works one day with his father, and his attention was called to this fact, whereupon he said he had a suggestion he would like to make. Upon being given paper and pencil, he made the accompanying diagram



A BOY'S INVENTION.

after a few minutes' thought, stating that the steel bars could be arranged to form either squares or rectangular tiles. It was then explained to him by the manager that it would be necessary to provide some means of retaining the bars in position, as the moulds had to be subjected to a heavy hydraulic pressure, which would separate them, unless they were fastened securely in place. He then suggested backing the bars with plates as shown, which should be provided with holes, enabling them to be screwed firmly to the table, which should be provided with corresponding holes. In this way a solid form was provided, which could be used as a universal mould for tiles of various sizes and shapes. The idea was a good one, and reflects much credit for originality upon its youthful inventor.

Luminosity of Colored Surfaces.

At the last meeting of the Physical Society, Captain Abney read a paper "On the Measurement of the Luminosity of Colored Surfaces," which was illustrated by experiments. In a communication to the Royal Society, General Festing and the author have described a method of comparing the intensity of the light of different parts of the spectrum, reflected by various pigments, with that reflected from white; and luminosity curves have been constructed, the areas of which give comparative measures of the total luminosities. This method of comparison is accurate, but requires considerable time, and the author has devised a more rapid process. The colored surface whose luminosity is to be compared with white is placed beside a white patch within a dark box. A direct beam of light passes through an aperture in the box, and a black rod casts a shadow on the colored patch; another beam from the same source is reflected at an angle, and forms a shadow of the same rod on the white patch, the junction of the two shadows connecting with that of the two surfaces to be compared. In the path of the direct beam is placed a rotating disk with angular openings, adjustable while rotating by a single lever, and by this means the white patch can be made to appear too light and too dark in rapid succession. By gradually diminishing the range of oscillation of the lever, a position of equal luminosities can be found. The colored surface is now replaced by a white one, and the adjustment again made, and from the angular apertures required in the two cases the relative luminosities are determined. Comparisons made in this way—the numbers relating to which are given in the paper—with emerald green, vermilion, French ultramarine, etc., gave results in close agreement with those deduced from the luminosity curves obtained by the spectrum method.

Glucose.

The process of making glucose will be best understood by following the corn from the time it enters the factory until it runs out at a spigot, a clear, odorless liquid. The shell corn is first soaked for several days in water to soften the hull and prepare it for the cracking process. The softened corn is conveyed by elevators to one of the highest stories of the factory and shoveled into large hoppers, from which it passes into mills that merely crack the grains without reducing them at once to a fine meal. The cracked grain is then conducted to a large tank filled with rinsing water. The hulls of the corn float at the top of the water, the germs sink to the bottom, and the portions of the grain containing the starch, becoming gradually reduced to flour by friction, are held in solution in the water.

By an ingenious process both the hulls and the germs are removed, and the flour part now held in solution contains nothing but starch and gluten. This liquid is then made to flow over a series of tables, representing several acres in area, and the difference in the specific gravity of the two substances causes the gluten and the starch to separate without the use of chemicals. The gluten is of a golden yellow color, and the starch snow white.

By the time gluten has been completely eliminated the starch assumes a plastic form and is collected from the separating tables by wheelbarrowfuls and taken to a drying room, where it is prepared as the starch of commerce or is placed in a chemical apparatus to be converted into glucose. The conversion is effected by submitting the starch to the action of a minute percentage of dilute sulphuric acid, which, without becoming a constituent part of the compound, produces by its presence merely a miraculous chemical change. This change from starch to glucose is a gradual process, and has four or five well defined stages. On the addition of the acid the first change results in the production of what is known to chemists as dextrine. If at this stage the acid is neutralized by the addition of lime water, the process is choked and dextrine is the permanent product.

If the process is allowed to go on, the acid, however, works a second change, and maltose is the result. Here the process can, if necessary, be interrupted by neutralizing the acid by means of lime water, and for some purposes in the art of brewing this is sometimes done. The third and important stage in the chemical change wrought by the action results in the production of glucose, and just here is where the greatest skill of the chemist is required.

The product must show by test that it responds to the chemical formula $C_6H_{12}O_6$. By comparing this formula with that of starch, which is $C_6H_{10}O_5$—that is, six parts of carbon to ten of hydrogen and five of oxygen—it will be seen that the sulphuric acid has not added to the starch, but has taken up two parts of hydrogen, and the only gain in the starch is one part of oxygen. The lime water introduced to neutralize the acid forms with it a product called gypsum, which can be removed from the glucose without leaving any appreciable trace.

The fourth stage in the chemical process results in crystallizing the liquid, and then the product is called grape sugar. There is a fifth stage, in which caramel, or burnt sugar, could be produced were it of any commercial value. The gypsum, or sulphate of lime, formed by the neutralizing lime water and sulphuric acid, sinks by gravitation to the bottom of the vessel and the supernatant saccharine liquid is drawn off from the top. This is almost pure chemical glucose, but it is still subject to a filtering process through bone black, and refined in the same way as cane sugar is refined. The bone black has anything but the appearance of a purifying agent, but possesses the peculiar property of attracting to itself all coloring matter.

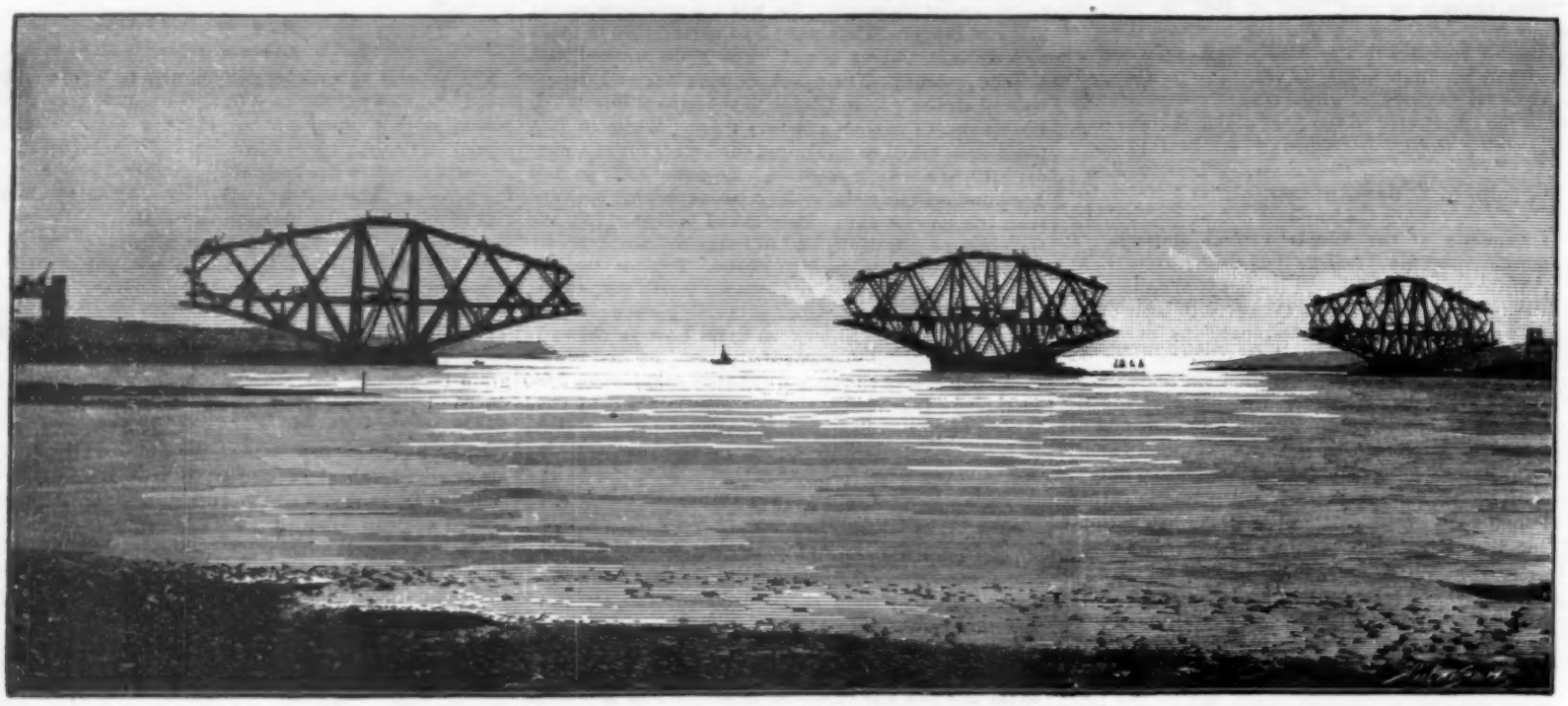
The glucose, passing through a labyrinthine system of filtering, is drawn off through spigots in the lower part of the building, and is ready to be shipped away in barrels. To give the glucose the appearance of cane sirup, as well as to impart some of the characteristic taste, a small amount of that sirup is added to suit the fancy of buyers.

To make grape sugar the glucose is dried in rapidly revolving vessels, from which much of the moisture escapes by virtue of the centrifugal force. Neither the glucose nor the grape sugar is used for domestic purposes, although either one is about two-thirds as sweet as the sweetest cane sugar. Glucose is chiefly used for fermenting purposes, and of late years has become valuable to the brewer in making beer and pale ales. It is also largely used in mixtures with cane sirups and molasses, and esteemed more wholesome than the cane product which is, at best, only a side product or residue in the manufacture of sugar.—*Amer. Analyst.*

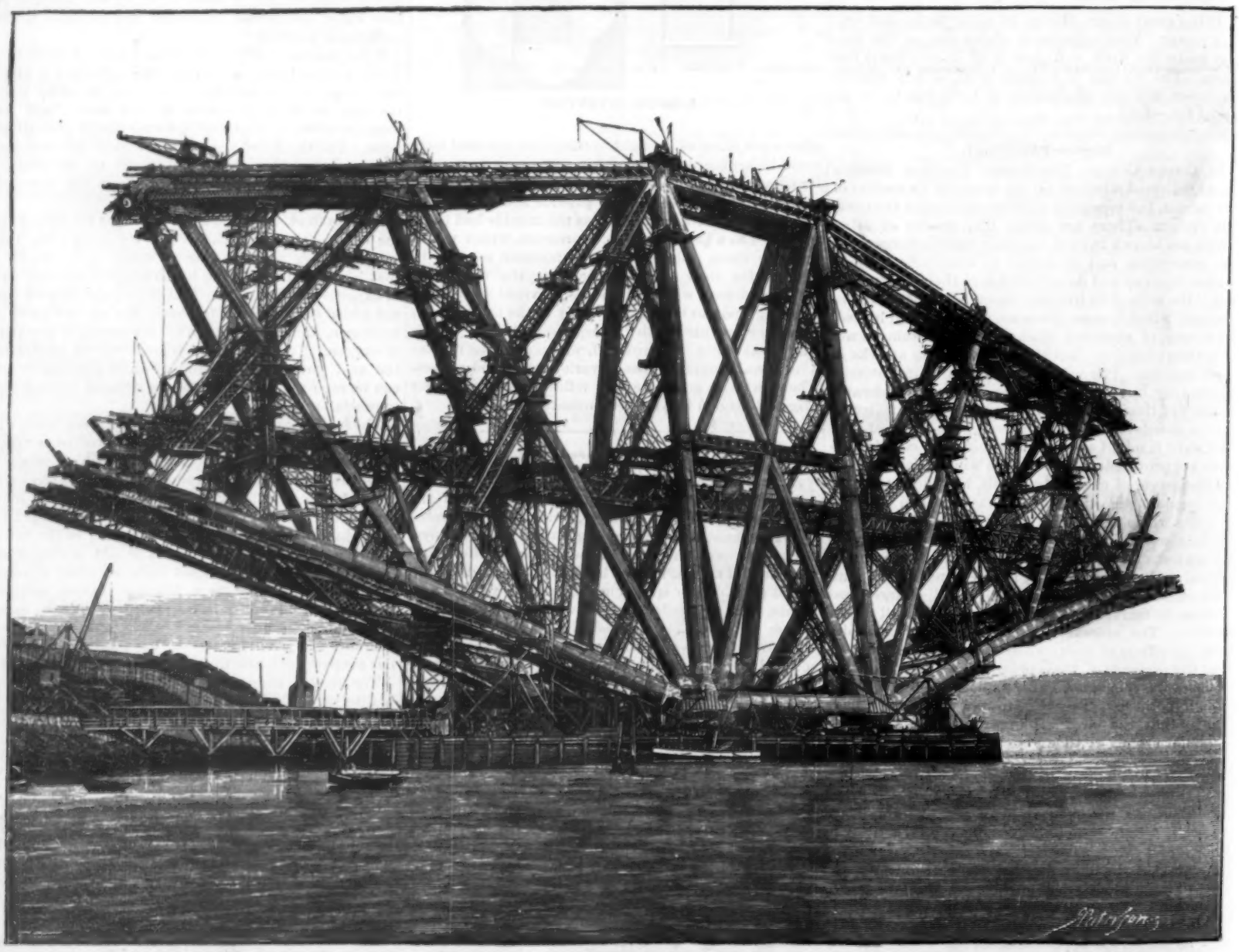
THE GREAT RAILWAY BRIDGE OVER THE FIRTH OF FORTH.

The construction of the great railway bridge to cross the Firth of Forth, at Queensferry, just beyond Dalmeny Park, where the opposite shores of Fifeshire and Linlithgowshire nearly approach each other, with the rocky islet of Inchgarvie between them, is one of the grandest works of modern engineering. It was designed, for the North British Railway Company, by Sir John Fowler and Mr. Benjamin Baker, has been four or five years in actual progress, and will be completed in the autumn of this year. The width of the estuary in this part is reduced by the peninsula of North Queensferry to a mile and a half, and on the south shore the water shoals rapidly, with a bed of bowlder clay and a very deep stratum of mud, but the Fife shore is an almost perpendicular cliff, and the intervening islet is a rock in the center of the deep channel, with 200 feet depth of water on each side, and with a strong tide current sweeping up and down on each side. It was impossible to erect piers anywhere but on this islet; hence the bridge must rest on three main piers, one at South Queensferry, one at Inchgarvie, and one on the Fife shore, besides two supplementary piers which serve to relieve the balance arms of the cantilever girders, and to connect the bridge with a long approach viaduct.

A cantilever is a girder supported at one point, its overhanging extended part being balanced by its weight at the other end. This engineering device is the most novel feature of the Forth Bridge. The main spans of the bridge are to be upheld over the deep water channels by the projecting ends of cantilever girders, with connecting central girders over about one-sixth of the span. Each cantilever girder is a complex structure framed of four vertical columns, standing not parallel, but from a wide base narrowing to the top; two bottom members, formed of horizontal tubes arranged in an upward curve of 680 feet span; two top members, consisting of box lattice girders arranged horizontally on vertical columns; twenty-eight struts, holding the top and the bottom together; and



VIEW OF THE BRIDGE FROM THE EAST.



FIVE MAIN PIER.

PROGRESS OF THE FORTH BRIDGE, QUEENSFERRY, NEAR EDINBURGH.

twenty-four ties, crossing and binding the struts, with secondary ties to assist in holding up the bottom, all made of steel. By these means, the Forth Bridge will be carried over two spans each of 1,710 feet (nearly a third of a mile), besides the half spans extending inland, where the ends of the cantilever girders, at and beyond the piers of support, are ballasted so as to counterbalance the weight of the suspended parts and of any trains passing over them. To allow for expansion or contraction of metal, the connecting central girders, resting on the cantilevers, each weighing about 800 tons, are only rigidly attached at one end, leaving the other end free. No one can fail to admire the mechanical ingenuity of the whole contrivance, which relies on the principle of "stable equilibrium," instead of a rigid union of all the parts of this immense and ponderous structure. It will scarcely, like the unfortunate Tay Bridge, be liable to be blown down by a gale of wind.

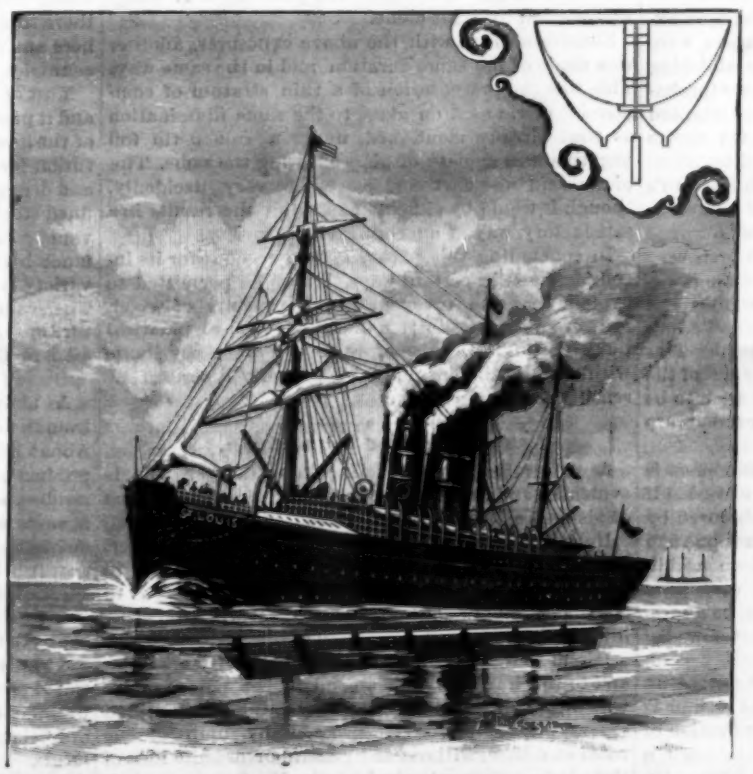
POURING WATER INTO A SIEVE.

Our engravings show a general view of the Forth Bridge so far as it is at present completed, and a more detailed view of one of the piers and the great double cantilevers resting upon it.

We may repeat, in conclusion, that each opening of the Forth Bridge is one-third of a mile in clear span, which unprecedented width is spanned by a steel structure made up of two cantilevers or brackets, projecting 675 feet from the piers, and a central lever connecting the ends of the cantilevers. As shown in the engravings, the cantilevers project about 400 feet from the piers, and pieces are being added to the ends at a rate which will complete the bridge this year. It was reported that, during the recent storms which did so much damage to shipping, the Forth Bridge had suffered, but as a matter of fact not a plate or bolt was shaken, although, in its present condition, the structure has not one-half of its final strength.—*Illustrated London News.*

ST. LOUIS TO BE A SEAPORT.

A company has been formed in St. Louis, under the title of the Mississippi River and Ocean Navigation Company, with a capital stock of five millions of dollars, having for its object to establish direct ocean steamer lines between St. Louis, the West Indies, South America, etc., thus avoiding the great expenses of transferring and reshipping goods at New Orleans. A large amount of valuable information and cogent reasons in favor of this new enterprise are given in a pamphlet issued by the company. The prospective trade to be commanded by such lines of vessels is set forth as very great and very profitable. In order to realize the project in a practical manner, the company proposes to build its steamers on the plans invented by Andrew H. Lucas and John F. Cahill, of which we herewith present an illustration. The ships are to have double hulls and drop keels, so they may readily navigate shallow waters.



IMPROVED DOUBLE-HULLED AND DROP-KEELED STEAMSHIPS.

The cut shows the manner of application of the adjustable or drop keel. When in actual use, however, the cylinders are not to be exposed, as shown in the illustration, as the strain would be too severe on the uprights by means of which the drop keel is suspended and made to ascend or descend between the two hulls, as shown in Fig. 2. When in use, the upper part of the drop keel is held firmly in place by stout steel braces constructed along the entire length of the inner sides of the two hulls.

The mechanism for raising and lowering it will be mounted in connection with the engine shaft of the vessel. It will be understood that the series of pinions or screws for manipulating the drop keel are to be run together and at the same rate of speed, so that there will be no straining or cramping of the parts in the cylinders. The movable keel may be lowered at will any distance equal to the loaded immersion of the ship. From the bow to a point over the forward end of the drop keel the ship is to be built solid, with watertight compartments. Her engines are to be of the triple expansion type, and her motive power the twin screw. The inventor has devised an original system of propulsion, by means of which every pound of steam power may be utilized and a higher rate of speed reached than is attained by any of the marine engines now in use. If this system should be found practicable, an extraordinary rate of speed is certain, as the construction of the ship affords excellent facilities for the use of auxiliary twin screws placed near the stern of each of the hulls. The loaded draught of a vessel of 1,000 tons will not exceed seven feet. The additional immersion of the drop keel will give the ship all the strength and stability requisite for safety in stormy weather and high rolling seas. The cylinders pass upward through the decks and are securely fastened between steel bridges equally distributed along three-fourths of the ship's length, thus relieving the immersed movable keel of all undue strain.

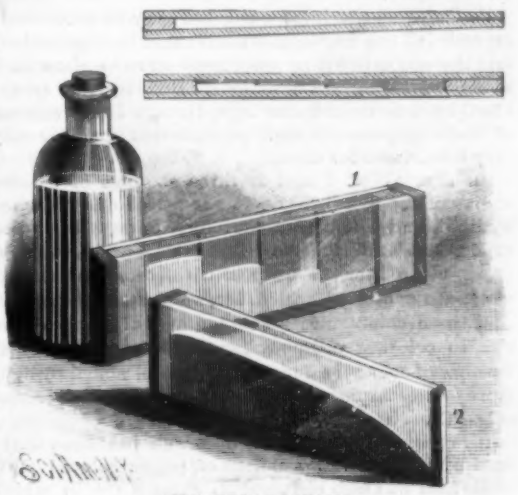
Each of the hulls is, likewise, provided with its own keel, so as to facilitate navigation.

EXPERIMENTS IN CAPILLARY FORCE.

What may be termed the reaction of capillarity as manifested between solids and liquids is divisible into two classes. One of these is illustrated in the case of a liquid wetting a solid, typical examples of which are found in blotting paper, in the drying action of a towel, and in many experiments founded on this general basis. Where the liquid wets the solid, the forces of adhesion and cohesion are both developed, and a distinct type of phenomena comes into play. But where the liquid does not wet the solid, as in the case of mercury against wood or glass, an action dependent on cohesion alone, or very slightly modified by adhesion, is produced. In the illustrations accompanying this article several illustrations of what may be termed the capillarity of cohesion are shown.

It is a well known fact that if water is poured between two plates of glass held a slight distance apart, but nearer at one end than at the other, the fluid will rise the highest between the plates where they are the closest. The liquid will thus form a curve, in general sense a hyperbola concave upward. The water is attached to the glass by adhesion, travels upward, and by cohesion draws the liquid column after it, naturally to the greatest height, where there is the least liquid or the lightest column to be drawn. But if for the water we substitute mercury—a fluid which does not wet glass—the force of adhesion does not appear, cohesion draws the mercury strongly together and pulls it down to the greatest distance, where there is the least mercury to be acted on. This place is, of course, where the glass is closest, so that if mercury is poured between two plates of glass nearer at one end than at the other, it will rise to the greatest distance where the plates are farthest apart, and will descend in a curve convex upward. This curve will be directed toward the part of the glass plates which are nearest together. It is the reverse of the water curve.

In Fig. 2 of the drawings is shown such a trough, containing mercury. The upper sectional figure shows its construction. It is made of two pieces of glass cemented together by means of a little sealing wax, two of their edges being in contact, and two held apart by a slip of glass or cardboard. A piece of paper may be cemented over the bottom with gum tragacanth as a cementing material, or the opening may be closed with sealing wax or otherwise, as desired. This forms a wedge-shaped trough. When mercury is poured into such a receptacle, it takes a very peculiar shape, shown in Fig. 2. In Fig. 1 of the same illustration a variation on this is shown. Here the tank is constructed of plates of glass parallel one to the other; but before being put together, a series of strips of paper are pasted on one of them, each slip being about one-fourth of an inch or more shorter than the one beneath it. In this way the open space is divided into a series of step-like divisions of varying width, each division, however, having practically parallel sides. If mercury is poured into this trough, it will arrange itself into a series of steps, as shown in Fig. 1.



MERCURY TROUGHS.

In the next illustration, the same idea is carried out and applied to water. A cup is made of No. 50 gauze. The seams are joined by soldering, and the bottom has its edges bent upward, and is also soldered in place. It is then heated, when perfectly dry, and thoroughly coated with paraffine. This fills the meshes. When sufficiently coated, it is again heated, and the paraffine is expelled from the meshes by sharply blowing against them. If now the cup is held as shown and water is poured into it very gently and along one of its sides, there is no difficulty in filling it to the depth of three inches or more with water. This illustrates water held in a sieve. If a finger of the hand holding the cup is wet, the water as it rises to the level of the moistened part will at once rush out. If, when the cup is full, the wet finger is rubbed on the bottom, this will be sufficient to cause the water to escape. The cup will float upon water for an indefinite period, but if inverted and placed like a diving bell, will at once sink.

The water in this experiment practically forms a film or membrane, not touching the wire gazue and holding the body of the water together. The figure on the upper part of the cup is an attempt to show how the water rests upon the wires. The little film is bowed down between every two wires, forming a species of sac.

The experimenter must remember to have his hand perfectly dry. It is very curious, as the water rises, to feel its chilling effect through the wire gauze without the hand being at all moistened.

Crowley's Brain.

Crowley was a chimpanzee. He was an interesting feature at our zoological museum, and his human traits offered much amusement to visitors. Crowley's portrait, and a description of his antics, was published in the SCIENTIFIC AMERICAN of October 23, 1886. He died a few months ago, and his brain has been examined by Dr. Spitzka, who finds that it weighs less than one-third that of a human brain, but in the course of the examination he made an important discovery. At the floor of the fourth ventricle in intelligent persons there are what are called auditory streaks, which are supposed to have something to do with hearing and the power to distinguish the different words of a language, and in the brain of this chimpanzee were found faint white streaks in this area—a fact more remarkable when it is borne in mind that in deaf mutes these auditory streaks are not to be found.

On Certain Surfaces Feebly Sensitive to Light.*

BY J. W. OSBORNE.

The specimens which accompany this statement are suggestive, inasmuch as they tend to illustrate the widely extended range of photo-chemical action and the part it plays in everyday phenomena. In thinking and speaking of substances sensitive to light, photographers and others are apt to remember only the haloid salts of silver, chromic acid under restraint acting on organic matter, asphaltum, and a few salts of iron and platinum, which short catalogue does, in fact, include all the sensitive bodies used in practical photography.

But as every one knows, this list may be indefinitely extended (if the degree of sensitiveness be disregarded), and the accompanying specimens serve to show such extension in certain directions. Broadly, the results should not be regarded as new, though in the manner of their preparation and presentation some novelty may be claimed for them.

On sheets Nos. 1 and 2, three samples of colored commercial paper will be found which are bleached by light, and which give, therefore, a negative when exposed under a negative. On sheets 2 and 3, exposed papers colored for the purpose with eosine and methyl violet are exhibited, which likewise establish the fact that these colors under the luminous influence give rise to colorless compounds. But, though a great number of colors used in the arts are bleached by light more or less rapidly, this is by no means a universal rule. On sheet No. 1, a small piece of commercial orange paper is shown, part of which has been darkened by exposure. Specimens of paper colored with picric acid will also be found on sheet No. 4, in which the darkening to a brown is very marked.

The duration of the exposures required to produce these photographic effects is very considerable when the change is carried to its maximum, varying from twenty to thirty-five or forty hours in direct light, which was the only kind of exposure employed in these experiments. Such substances are perhaps from four hundred to eight hundred times less sensitive than chloride of silver paper. Indications of photo-chemical action are, however, visible in much less time. On sheet No. 2, a piece of eosine paper exposed under two strips of black lace shows a faint positive after half an hour. Also on sheet No. 3 a piece of methyl violet paper similarly exposed shows the gradually increasing strength of the positive (by contrast) after one, two, and three hours.

The fact that printing and writing papers become brown by age is familiar to most persons, but that this change is essentially photographic is not a common belief. On sheet No. 5 will be found pieces of newspaper taken from the New York *Tribune*, the Baltimore *Sun*, and the Washington *Evening Star*, on which photographic images have been impressed by simple exposure under a dense negative. These papers were subjected to no preparatory treatment, establishing the fact that the newspapers we read daily are (probably all) printed on papers sensitive to light and adapted for the production of positive pictures. On sheets Nos. 6, 7, 8 and 9, such pictures will be found on *Evening Star* paper, made by direct exposure to the sun's rays, under collodion negatives. A fact of some significance is that some of the experiments on *Evening Star* paper were made on sheets which had been very carefully washed before exposure. The washing was done by causing a rapid film of water to flow over and under the paper at the same time, for two and a half hours. The paper was then dried and exposed. This treatment did not seem to affect the sensitiveness of the paper to light, and the presumption would seem to be justifiable that the sensitive compounds present are not soluble in water.

The time required to produce the maximum effect is about fifty hours, but this must often be exceeded if any part of the negative is in the least obscured by cloudiness. The color produced by exposures on such papers is peculiar. When the paper is clean and in good condition, as in Nos. 6, 7, 8, and 9, a very pure golden bronzy color is produced, which can be appreciated only in strong white light. I will not now discuss the nature of the resulting brown yellow compound, except to say generally that it is not easily acted on by the chemical reagents, and that it undergoes a very peculiar darkening by the application of heat alone, as by ironing the paper bearing such a photograph with a moderately hot flat iron. On sheet No. 8, a piece of paper is mounted with two tints on it longitudinally, half of which (divided across the tints) was heated in the way described, and which is, in consequence, much darkened. The print above it on the same sheet was also so developed or intensified.

Sheets Nos. 10, 11, and 12 have mounted upon them pieces of white pine, of different qualities, upon which photographs have been produced by exposures under stencil negatives, made by cutting openings in tin foil, and pressing it into close contact with the surface of the wood by means of a plate of glass properly clamped thereto. The exposure required to produce these photographic images varies from thirty to fifty or sixty hours. On sheet No. 13 a piece of poplar is shown, the picture on which was produced in twenty hours, for it seems probable that of all the woods in common use, poplar is the most sensitive and gives the darkest color when fully exposed. In making these experiments it is important to obtain a fresh surface on the wood, to effect which, in the case of an old piece, a good deal of the outside has often to be removed by the plane, for the penetration of the light is often considerable.

It seems probable that this darkening of wood (which is very commonly though rather vaguely attributed to the action of the air) is related to the photographic effect obtainable on printing papers. These are now hardly to be had without an admixture of wood pulp, and the present inquiry (inasmuch as it proves the phenomena to be strictly photographic) may have a practical bearing if it points to means which will keep printing papers white indefinitely.

On sheet No. 1, the bleaching action of light upon a dried leaf is exhibited, and on No. 5 a piece of parchment is mounted, which has also, though substantially white, become a little whiter where the light has acted. As far as it goes, this would tend to show that the "yellowing of parchment by age" is not a photo-chemical process. This parchment had a very long exposure.

As connected with this general subject, I would call to mind the investigations of Mr. Thomas Gaffield, of Boston, who established conclusively more than twenty years ago the slow effect of light on colorless glass, in gradually giving it color, sometimes pinkish and sometimes yellow, the former being apparently due to a reoxidation of the reduced manganese employed to counteract the iron. These changes often required years for their completion.

Experiments only just completed tend to show that pure cellulose in the form of the finest filtering paper is not sensitive to light, at least a constant exposure in a horizontal position to diffused and direct sunlight failed in two weeks to produce any perceptible change in color. On the other hand, the same filtering paper colored with picric acid and similarly exposed for the same time, about one hundred and forty hours of diffused and direct sunlight, gave a coloration as before, when sized and calendered paper of the best quality was the kind treated with the acid. On sheet No. 14 two pieces of the above filtering paper prepared with picric acid and exposed horizontally, as stated, will be found, but one of them has been washed in hot water till all the soluble matter has been removed. This treatment of the exposed print tends to raise the contrast by letting the darkened parts appear as on white paper. It also shows the insolubility of the darkened portions in hot water, the production of which was effected by light alone.

Simultaneously with the above exposures, another was made of the same duration and in the same way. This was the presentation of a thin stratum of commercial picric acid on glass to the same illumination as that already mentioned, under a stencil tin foil negative and a plate of glass covering the same. The picric acid was darkened as before very decidedly, though it would be difficult to exhibit the results in a satisfactory way at a meeting of the society.

In concluding this paper, and to account for its incompleteness in certain ways, I may be permitted to explain that the investigation, the results of which are here given, was not undertaken with a practical purpose in view, but simply to determine the limits within which bodies may be properly described as sensitive or non-sensitive.

* Presented before the Society of Amateur Photographers of New York.

The Trials of an Architect.

A writer in the *Ohio Valley Manufacturer*, who is evidently an architect, depicts some of the trials one of his profession has to endure from his client.

He enters an architect's office and starts the conversation by stating his wants, desires, etc., in regard to the future house. His greatest want invariably is to get the house for about one-half what it will surely cost him.

His next want is to design the house from within, and in this he has an able second in the person of his wife or daughter, as the case may be, and oftentimes several persons more. He proceeds by jumps of one room at a time, without any general or definite idea of the whole. He wants the hall like Mr. Some-one-else's hall, the dining room like that of some other house, and so on, utterly regardless of anything else but to have them just so, and nine times out of ten, when he gets it that way, it is not what he wants at all, it is but a taking fancy of the moment, and he allows it to mislead him without thinking it seriously, for when completed, Mr. Some-one-else's hall and Mr. Some-other-house's dining room are entirely of a different plan and feeling from each other, and so on through the house. They are all designed by different minds upon different principles, probably the hall from a seaside cottage and the dining room from some city house, but no matter, he pays his money and he must have it. Thus the architect receives his idea of the future house, from basement to roof, and he makes his plan accordingly.

Then he is confronted with one of the meanest tasks that can be imposed upon a designer who takes pride in his work at all, namely, to design an exterior to fit the plan as laid out, a scheme as ridiculous in principle as to make the window frames to fit some old sash that may be on hand.

The whole house has been designed without reference to the exterior, and hence the public is confronted with a flat, featureless building which is an eyesore to the beholder; or else the building is covered with an excess of meaningless ornamentation put on to hide the defects of a plan designed without due and proper thought, but to please Mr. Must-have-it.

Moral: Leave the full designs and surroundings to the more experienced and better judgment of the architect.

Uses of Cotton Seed.

The cotton seed which of late years has been put to such profitable uses is steadily increasing in popularity. Heretofore the seed after being taken from the cotton boll was thrown away, but now it is about all put to use and readily sold. From this valuable seed is extracted the much used cotton seed oil, and from the residuum are obtained cotton seed meal, cotton seed bran, and cotton seed hull ashes.

The seed after being taken from the cotton gin goes through a "linter machine," which takes off the short staple cotton which the gin does not remove. This short staple cotton is sold mostly to concerns who use it for cotton batting. It is also used for other purposes. After all the fiber is taken off, the bare seed is cracked and the kernel is separated from the hull. The kernel is then ground and put under severe heat or cooked. In the heated state the most oil can be extracted, and it is therefore put into a large iron caldron and is subjected to a heavy pressure. When thoroughly pressed, the residue or meal is in the form of cake.

USES OF OIL.

Cotton seed oil is used for numerous purposes, and is displacing other popular oils, owing to its cheapness and healthfulness, as it is purely a vegetable oil. This variety of oil is used very largely by lard manufacturers, who adulterate their lard with it. Although most people would prefer pure lard, it is claimed that the cotton seed oil adulterated with the hog fat lard improves the quality of the stock. The hog lard contains more than twice as much water as the seed extract, and consequently one pound of adulterated cotton seed oil lard goes much further than the pure stock. Large quantities of the seed oil are yearly shipped from this country to the countries on the Mediterranean where olive oil is produced. It is used almost wholly there to adulterate the olive oil, which is then sold both here and in Europe as olive oil from the Mediterranean countries.

Most of the sardines are now packed in this new oil, and it proves to be successful. Bakers also buy barrels of the liquid, which they advantageously use in substitution for the more costly lards and greases. Chemists and druggists use considerable also. The white or refined stock is used to quite an extent in the Pennsylvania coal mines for lamp oil. Although the cost is much higher than that of petroleum, the safety of the variety is preferable to the more explosive kerosene. The crude stock is used extensively in the manufacture of soap, as is also the foots or residue left after the oil is made.

THE MEAL.

As above stated, after the oil has been abstracted from the kernel, the caked meal is left as a residue. About 150 mills which utilize the cotton seed use both products, the oil and residue or meal. Most of the residue is sent to England in cake form, where the farmers crack it and feed their cattle with it. A large amount has been satisfactorily used in the West, and now it is being sold in this market, it is claimed, quite successfully. This meal is claimed to excel all others as a feed for cattle. That used in this country is not in the cake form, but ground, and now brings from $26 to $26.50 per ton. Last year the prices ranged from $23.50 to $24 per ton, the advance being caused by an unprecedented foreign demand. Cotton seed meal is not only claimed to be better, but also cheaper than other meals.

In St. Louis there is situated a mill which makes cotton seed bran from the hulls, and claims that it is superior to other coarse feed and costs much less, bringing about $21.50 per ton. Most of the mills burn the hulls of the seed for fuel and sell it for fertilizing purposes. These ashes are bought by farmers in conjunction with the meal and mixed by them for fertilizer. This mixture is said to contain an abundance of potash and phosphoric acid, which have very powerful fertilizing properties. The ashes are worth from $30 to $32 per ton. This fertilizer is not exported, but used here, in this country mostly in the Connecticut valley, by the raisers of tobacco. The supply is limited, and dealers say they could have sold twice as much if they had it.—*Commercial Bulletin.*

APPARATUS FOR COMPOUNDING RECTANGULAR VIBRATIONS.

BY GEO. M. HOPKINS.

The compound pendulum illustrated by the annexed engraving has advantages over those of the usual form, in being adapted to the ordinary horizontal lantern and in being less cumbersome and more easily managed. Perhaps the most important difference between this and other instruments of its class lies in the tracing arm and point. With this apparatus the beautiful curves of Lissajous appear on the screen, while the arm that traces them is invisible. With densely smoked glass this feature is not so apparent, but when colored collodion tracing films are used, it is a novel sight to witness the development of these intricate figures by a point having no apparent support or guide.

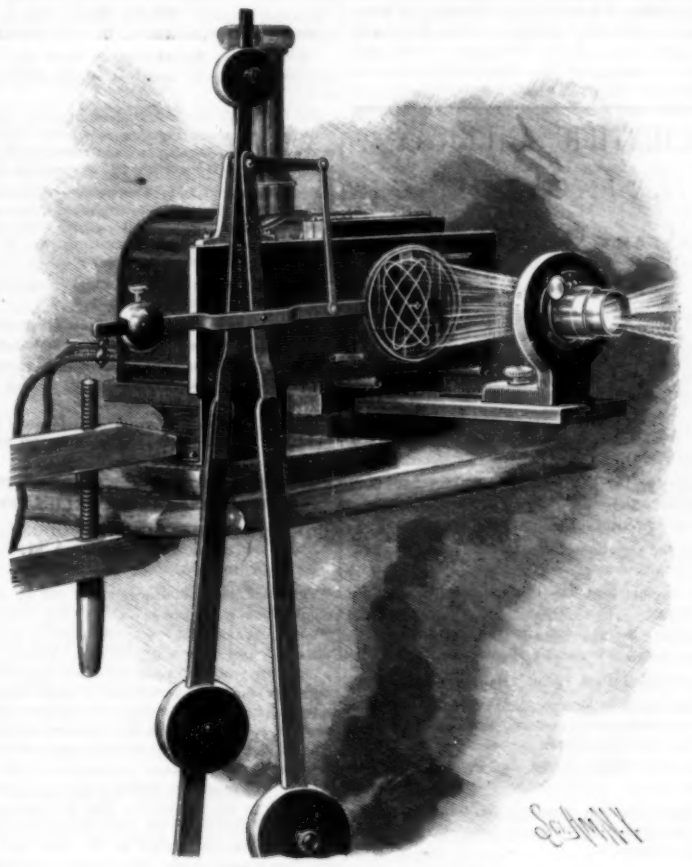
An apertured board having a recess for receiving the prepared glass plate forms the body of the apparatus. This board is connected by an iron standard with a base piece which is clamped to the lantern table in the manner shown. To the upper edge of the board is secured an arm provided with a horizontal stud upon which are pivoted two pendulums. The rear pendulum is prolonged above its pivot, and is provided with a right angled arm projecting toward the lantern, parallel with the back board. The upper end of the rear pendulum is provided with two or three interchangeable weights, varying from two to six pounds, and the lower end is provided with a movable weight of twelve pounds. The front pendulum is suspended from the same pivot, and is also furnished with a movable twelve pound weight. To the rod of the front pendulum is pivoted an offset bar, provided at one end with an annular frame containing a transparent glass disk and having at the opposite end an adjustable counterbalance weight. The glass disk is provided with a small central aperture, in which is inserted a fine needle. To the offset bar, half way between its connection with the pendulum rod and the needle, is pivoted a rod which is pivotally connected with the horizontal arm of the rear pendulum.

The offset bar is made of thin spring material, and is bent so that the needle presses lightly upon the prepared glass held in the recess of the back board. The prepared glass plate is retained in the position of use by two spring clips pivoted to the back board and arranged to press upon diagonally opposite corners of the glass. The needle is held away from the glass while starting the pendulum, by means of a thread (not shown) attached to the annular frame and connected with a fixed support in front of the frame and distant about a foot.

The adjustment of the weights for the different figures is ascertained by experiment, and the position of the weights is accurately indicated on the pendulum rods. The apparatus is placed in position on the table and the lantern is adjusted to it.

The colored collodion for the films is prepared by thinning ordinary plain collodion with alcohol diluted with water, then adding to it an alcoholic solution of aniline of any desired color. The glass plate is prepared for use by flowing the collodion over it and allowing it to dry. If the film proves too hard and tough, it may be modified by adding a small quantity of water to the collodion. This film gives a uniform tint on the screen and is dense enough to clearly show the lines of the tracing.

After the tracing point has been drawn back in the manner described, and the prepared glass plate is in place, the pendulums are drawn aside and the rear one is released. At a certain phase of its vibration (which will be determined by experiment) the front pendulum is released. If the needle describes the desired curve, the annular frame is released, when the needle traces the figure which appears upon the screen.



COMPOUND PENDULUM.

Prison Labor Contracts.

A very excellent suggestion has been made, which, if carried out, would tend to do away with much of the opposition to prison labor that is expressed by workmen. It is that the prisoners should be kept at work upon diversified industries. Thus the shoe manufacturer would experience no tangible competition, and the foundryman would not have the somewhat just grounds for complaint which have been afforded him in the past. The proposed system would be beneficial in all save one aspect. It would prevent the prison labor from being so profitable as it is now. But as prisons should be conducted for the protection of the community and reformation of the criminal, such a consideration is of very little weight. The various lines of industry would be adapted to the different intelligences of the convict, and when he left the prison the trade learned there would not be branded as a "State prison trade."

Harvard College Observatory.

From the recent annual report of Professor Edward C. Pickering we glean the following:

The photographs required for the second investigation on the spectra of the fainter stars would probably now be completed, at least for the northern stars, but for the unusual cloudiness of the last few months. It is expected to complete them during the coming winter, and then to send the instrument (the eight inch Bache telescope) to Peru, where both the investigations named above will be extended to the southern stars, thus rendering them complete for the entire sky. The detailed study of the spectra of the brighter stars with the eleven inch Draper telescope has been extended by the use of plates stained with erythrosin. The sodium line D in these spectra has thus been photographed as a double line. A catalogue has been formed of the lines in some of the brighter stars. In Sirius the lines, except those due to hydrogen, are very faint. But nearly four hundred of them have been measured in different photographs of this star. Fifteen are recorded between the lines H and K. A beginning has been made of the study of the spectra of the variable stars, but this work can probably be better done with the twenty-eight inch mirror. The latter instrument is now mounted, and experiments have been in progress with it for several months. The images show good definition, but the apparatus for producing the spectra has not yet given entirely satisfactory results.

The investigation of the clearness and steadiness of the air at Cambridge has been continued by the photographic methods mentioned in the last report. These are as follows: Photographs of the trails of the spectra of bright stars, photographs of the trails of stars near the North Pole and near the horizon, and photographs of the sky at different distances from the sun. The thirteen inch and eight inch telescopes mentioned in the last report were mounted early in the year, and the first of these instruments has been kept in nearly constant use since then. Eleven hundred photographs have been taken of a variety of objects to show what results may be expected under the atmospheric conditions existing at Cambridge.

Photographs have been taken of 112 double stars whose components are two seconds or more apart, and either of them as bright as the seventh magnitude. The relative brightness of the components will be determined, as well as their positions. The stars have also been allowed to trail over the plate, and this gives an excellent test of the steadiness of the air. Among other investigations made with this instrument are the determination of the actinic albedos of the moon and planets and the absorption toward the limb of the planet Jupiter. Photographs were obtained of the outer satellite of Mars, and of all the satellites of Saturn and Uranus except Mimas. It was shown that no undiscovered satellite of Saturn existed revolving in an orbit between Enceladus and Iapetus, unless it was more than a magnitude fainter than Hyperion. Probably no such satellite exists outside of Iapetus. Charts were constructed of the region near the North Pole, of the Pleiades, and of some other clusters and nebulæ. A study was also made of various lenses for enlargements and of various camera lenses. Sundry other photographic investigations have also been carried on. The total number of photographs taken in this department of the observatory during the year is about thirty-five hundred.

A Railway Tunnel between the United States and Canada.

Preparations are now being made on both sides of the river to recommence work on the great railroad tunnel under the St. Clair River at Port Huron. Early last year considerable preliminary work was done and $125,000 was expended; but, after two or three months, work was suspended, and has remained in that condition ever since. It was found that the sinking of shafts on the bank of the river on either side presented a great many difficulties, and finally the Grand Trunk Railway Company took the work out of the hands of Sooy Smith & Co., of New York, the contractors, and decided to take charge of the project itself.

Now, after looking the ground over, the company has decided to go back from the river some distance and commence work on the tunnel proper. The work of excavation on the American side will begin about 2,500 feet back from the river, and from this point there will be a steady decline till the necessary depth under the bottom of the river, about 50 feet, is reached. The drift for the tunnel proper will be 22 feet in diameter, and the distance from one river bank to the other is 2,200 feet. The tunnel will have a drop of 90 feet to the mile, the lowest end being on the Canadian side.

The work of excavating in the tunnel will be done with large steel "shields," 22 feet in diameter. These shields will be driven into the earth with 24 hydraulic jacks, each with a pushing force of 125,000 pounds. A large hydraulic engine will be used to work the jacks. Five railway tracks for small trucks will be laid in the bottom of the tunnel, and as fast as the earth is excavated it will be loaded on these trucks, which are each capable of holding two cubic yards. A cable running from a large hoist engine through the tunnel to the cars will pull them up to the surface, where the dirt will be loaded into other cars to be carried away.

As the earth in the tunnel is removed a gang of men will follow with the lining of the tunnel, which is cast iron. The tunnel will thus be completed as the work progresses. A monster blower engine is suitably situated to force air into the tunnel through a 24 inch pipe. A large electric light engine will furnish 300 lights, and it is proposed to make the interior of the tunnel as light as day. A force of 125 men will be employed on each side of the river, and the work will be pushed night and day.

It is expected that the workmen from each side will come together about 700 feet from the Canadian side. The approach to the river is nearly a mile longer on the Canadian side than on the American, as the up grade is all on the land side in Canada. The approaches will not be tunneled until the tunnel under the river is completed. The tunnel, as finished, will consist of 2,500 feet on the American side, 2,200 under the river, and 4,000 feet on the Canadian side. There are now at work 125 men on the Canadian side and 60 on the American side. Another large addition was made to the working force January 2, when active operations were begun, and they will be vigorously pushed henceforth, it is asserted.

It is estimated that the work will cost $2,500,000, although well-informed men predict that it will cost nearer $5,000,000. President Sir Henry Tyler and Manager Hickson have been heard to remark that it will be completed if it costs $19,000,000.—*N. Y. Times.*

Copyright in Judicial Opinions.

The Supreme Court of the United States has rendered a decision in reference to the copyrighting of judicial opinions, in the case of Callaghan *et al. vs.* Myers. The appellee brought suit against the appellants for infringing upon a copyright secured to him by the reporter of the Supreme Court of Illinois by publishing certain volumes of the Illinois reports. The court decided in favor of the appellee, holding that while copyright cannot be secured for the text of the opinions of the judges, the reporter of the court has the right, in the absence of any legislation forbidding him to do so, to secure a copyright for the title, headings, notes, syllabi, and arrangement of the opinions, and that as the book would be of no value without these copyrighted portions, the whole book may be copyrighted. The court, said, however, that this copyright will not hold good where it is sought to be procured in behalf of the State.

THE secrets of much success in this world are cash, confidence, cheerfulness, and constancy.

RECENTLY PATENTED INVENTIONS.

Railroad Appliances.

TRANSMITTING POWER.—Timothy W. Lemieux, Duluth, Minn. This invention covers a device for transmitting a reversible motion from a continuous running cable, for use with traction railways, which will effectually operate as a means for reversing the moving direction of the car, and also make a simple and positive gripping device in its connection with the cable and the car.

CAR BRAKE AND STARTER.—John B. Swaim, Newbern, Ind. Adjacent to a disk rigidly mounted on the car axle is a ring inclosing a coiled spring, one end of which is secured to a projection on one side of the disk, while the other end is secured to the ring, the spring being wound up by the stopping of the car and giving out its energy as the car is started, or to assist the car over up grades, the invention covering numerous novel features facilitating the working of this principle.

CAR COUPLING.—Samuel T. Grimmett, West Plains, Mo. This is an improvement in couplings employing a link and pin, and provides means whereby the coupling may be effected without the operator going between the cars, spring arms being secured within the drawhead, and one of the arms having a socket arranged to receive the end of a link.

CAR DOOR.—Edward B. Searles, Baltimore, Md. The door is made with peculiarly constructed shoes or bearings, with novel connections with the door, and novel door securing or fastening contrivances, to prevent the entrance of flying sparks or of moisture around the door.

CAR HEATER.—John Q. Winfield and Benjamin H. Strickler, Broadway, Va. This invention consists of certain novel parts and details, and combinations thereof, for an improved car heater, designed to furnish pure heated air to the cars, while not liable to set the cars on fire in case of accident.

RAILROAD TIE.—Michael Maloney, Ironton, Ohio. It is a metallic tie made cross shape in cross section and having openings in its top flange and offsets on its horizontal flanges, a bolt secured to the top flange having a head projecting on the base of the rail, being very simple and durable, and permitting an easy placing or removal of the rail, which it is designed to hold securely in place.

Engineering.

SHAFT BEARING.—Benjamin A. Dobson, Bolton, Lancaster County, England. A non-rotating metal bushing forms a journal for the shaft, and is fitted with an eccentric sleeve, which is fitted within a second eccentric sleeve supported by the pedestal, with means for operating the eccentrics to adjust the position of the shaft with the bushing as required, being particularly intended for use with carding engines.

AIR DRAUGHT ENGINE.—Otto A. Benkendorf, Wilmot, Kansas. This invention covers a novel arrangement of wheels and air guides upon a vertical rotary shaft in an upright air flue, the upward draught of which may be stimulated by heat from below or by a ventilating cowl on the top of the flue.

Miscellaneous.

BLOW PIPE.—Edward B. Powers, Taunton, Mass. The ordinary blow pipe is provided with air and gas cut-off valves, which are operated by pressing upon a spring-supported rod, the head of the latter being in such relation to the stand of the blow pipe that it may be easily reached by the hand of the operator when taking up the blow pipe or laying it down, the invention also covering improvement in the air valve and its connection with the gas valve and operating rod.

BEVEL GAUGE.—Milon O. Godding, Monrovia, Cal. It is a hinged plate or guide, with supporting plate adapted for attachment to the utensil with which it is to be used, the guide having curved or segmental guide rods and a graduated segment, with which registers a pointer or index also applied to the supporting plate, with other novel features, for producing any required bevel or a cut of any angle.

MOULDING MACHINE.—Martin W. Walker and William Jowitt, Sing Sing, N. Y. A carriage carrying an endless belt supports the moulds and passes them through a sand machine in which sand is filled into the mould, after which the moulds are distributed on the floor of the foundry.

MAKING MALT.—Justin Whitney, Boston, Mass. The apparatus employed consists of a vertical hollow shaft to which rotating horizontal pans are attached, in which the grain is at first exposed to a forced current of moist air at low temperature, subsequently to a forced current of moderately heated air, and later on more highly heated air, until the malt is finished.

STEREOTYPE PLATE.—Lucius Goss, Upper Montclair, N. J. This is a plate cast with several spaced or separated columns joined at the ends, whereby the longitudinal sewing of the columns is avoided, and whereby the edges of all the columns in the plate may be trimmed at one operation.

FIGURED FABRIC.—Thomas Taylor and Jacob Warburton, Bolton, Lancaster County, England. The fabric is made with two shuttles, one carrying a coarse weft for the back and filling of the figure, and the other a fine weft for the face of the ground and figure, two warps being employed, one woven tight and the other slack, to produce figured fabrics with a raised fine figure upon a level ground, for bed quilts, toilets, etc.

BOAT.—Albert L. Shears, St. Louis, Mich. The planking is first heat over a form and its ends secured at the stem and stern, transverse bands being passed around the structure from the gunwale and adjusted to draw the longitudinal edges of the planking together, the boat being made without the usual ribs, the keel being detachable, and the seats removable, supported on angular brackets.

FURNITURE DRAWER.—George Bower, Fayette, Mo. A roller is journaled on the rear of the drawer, with projecting ends, around which cords are wound having their ends secured to the front and rear of the casing, making a guide device whereby the drawer may be moved in and out of the casing in an easy and effective manner without sticking.

INHALING TIP.—Myron S. Green, New York City. This tip, adapted to fit a vertically bored cork inserted in the mouth of a bottle, is so made that when the stem is but partially screwed into the socket, the operator, having the nipple end of the stem inserted in the nostril, may inhale or exhale without removing it, while by screwing down the stem the bottle is effectually sealed.

WATERPROOF COMPOUND.—Carl Grunzweig, Ludwigshafen-on-the-Rhine, Germany. It is a granular, non-heat-conducting compound, consisting of ground cork, the granules of which are provided with a thin external coating of resin and asphalt.

VELOCIPEDE.—Calvin Jackson, Jacksonwald, Pa. The vehicle allows leveling of the axles and plumbing of the main driving wheel tires on transversely sloping roads, also an arrangement of a main central seat frame allowing it to be shifted laterally to level the seats, the machine being more especially adapted for four riders, and embodying various minor improvements.

WAGON BRAKE.—James R. Robinson, Cornelia, Mo. A sliding brake frame is employed, having brake shoes pivotally connected by a rod with a lever pivoted to the side of the wagon adjacent to the driver's seat, the brake being easily adjusted and effective, while simple in construction.

FIRE ESCAPE.—Rudolph A. Reiss, Hoboken, N. J., and Edward Pettenkofer, New York City. It consists of a casing with automatically opening doors attached to a building, a frame detachably secured in the casing, with a trough-shaped chute, and ropes extending beyond the chute for detaching the frame from the casing and drawing it down.

SCIENTIFIC AMERICAN BUILDING EDITION.

JANUARY NUMBER.—(No. 39.)

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NEW BOOKS AND PUBLICATIONS.

THE CONVERSATION METHOD: FRENCH. By Edmond Gastineau, A.M. Ivison, Blakeman & Co., Publishers.

This work, just published, starts out by giving the pupil idiomatic phrases of an every-day nature and necessity, just as a child hears and takes up one by one the set phrases spoken around him. These idioms and phrases are rehearsed again and again in conversations, although constantly varied and enlarged upon by the introduction of new words. In this way, the pupil's stock of necessary words and phrases constantly increases, and he soon finds himself master of a sufficient portion of the language to express all his ordinary wants. The process is vivified and made interesting in this book by the assumption that the learner has just landed in Paris, where he finds himself surrounded by the circumstances peculiar to the place and country, and thus is made to learn and to use in conversation just such things as he would need to say if he actually were in France. He goes through railroad depots and custom houses, to hotels, where he orders his rooms, meals, etc., to stores, where he calls for goods and discusses their color and quality; to theaters, concerts, museums, to the opera, the Salon, etc., conversing here about the play and players, there about composers, music, and singers, elsewhere about pictures and painters, etc. French literature even is treated in short but interesting fashion. So, the learner is constantly moving in a French atmosphere, while his training ranges all the way from practical and every-day things to broader and more intellectual subjects. Meanwhile, the grammatical phase of language is by no means neglected. But it is studied subordinately to the conversational element, and in such way that by the time the pupil has reached the end of the book, he finds that almost unconsciously he has acquired a systematic knowledge of the language as well as the power of speaking it. A system of figured pronunciation also accompanies the text. This is based on values as found in Webster, and has evidently been worked out with great care and accuracy. It forms a valuable addition to the work, and makes it also admirably adapted to the purposes of self-study. For the idiomatic excellence of its vocabulary, a happy combination of the interesting with the practical, and the thorough treatment of the language, the conversation method as here presented is admirable, and the more it is examined and studied, the more highly it will be appreciated.

FORTSCHRITTE DER ELEKTROTECHNIK. Quarterly report of the latest inventions in electricity, including telegraphs and signals. Edited by Dr. Karl Strecker. Second volume. First number for 1888. Berlin: Julius Springer, 1888. Pp. 197.

In this report are compended the names of inventors and writers on applied electricity, with a short description of the devices and conclusions reached by the various writers and inventors. The patents, periodicals, etc., in which the several inventions and reports can be found are given in full, with date, etc. The first chapter treats of electro-mechanics, with its various subdivisions; the second of electro-chemistry, with the three subdivisions of primary and secondary batteries and applied electrolysis; the third part relates to telegraphs, telephones, and signals; the fourth to measurements; and the fifth and last to earth currents, atmospherical electricity, lightning rods, etc. The work will undoubtedly prove a very valuable reference book.

"Chemistry as She is Wrote."—A very curious book is the one that has just appeared from the press of Remington & Co. It is entitled "A Correlation Theory of Chemical Action and Affinity," by Thomas Hall Wright, M.D., of Balvia. It bears the same relation to chemistry that the famous book "English as She is Spoke" does to philology. As a sample we present the following paragraph: "The pressure Forces of Gravities, and the shine Forces of the Stars, and of the Sun, and of the Planets—in other words, the graduated pressure Force and the Graduated photothermal Force, namely plus and minus Heat and Light—heaviness and lightness, Light and Heat, Cold and Shade, the sidereal Fires or Shines, and the planetary Fires or Shines—exist throughout the Earth globe, and the Universe, and for All things, and therefore, also and indeed for Chemistry, and most especially for Cosmical Chemistry." There are between three and four hundred pages of such statements.

The Smith & Anthony Stove Co., of Boston, Mass., manufacturers of "Hub" ranges, have issued a beautiful calendar for 1889. It is in six sheets, tied together by a ribbon, each sheet being a fac-simile of a delicate water color drawing of charming sketches of child life, together with attractive landscape scenes.

The Union Metallic Cartridge Co., whose factory is at Bridgeport, Conn., in the 1889 calendar they are sending to their customers give representations of some hunting and frontier scenes, the most prominent figure being that of a young lady armed with a gun and deftly using the company's cartridges in the field of action in loading it.

The Gurney Hot Water Heater Co., of Boston, are likewise sending out a very neat calendar, on which is an admirable representation of their most improved form of heater, used for heating private dwellings or public buildings by hot water circulation.

The American Frost Meter Co., of Boston, has recently issued, in convenient form for reference, a book of meter tables giving number of United States gallons for each cubic foot, from one to 1,000,000, the tables being compiled by George A. Ellis, C.E.

☞ Any of the above books may be purchased through this office. Send for new book catalogue just published.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(158) I. E. P. asks for a formula for a good disinfectant. A. Sulphate or chloride of zinc dissolved in water is excellent; thymol is considered a good aerial disinfectant.

(159) San Diego and F. W. D. ask: 1. What are the ingredients that enter into the composition of hand grenades for putting out fire? A. Water mixed with different salts. Sulphate of soda and bicarbonate of ammonia are very good ingredients. 2. Are there any chemicals that will render kerosene oil non-inflammable, and what are they? A. No. 3. What is asbestos composed of? A. It is a natural mineral of the family of anhydrous silicates, formed by decomposition of the hornblende or pyroxene type of rock. 4. What preparation is used to make stage clothing and scenery non-inflammable? A. Tungstate of soda is very efficient. Sometimes scenery is painted on wire gauze.

(160) C. E. D. writes: I have a meerschaum pipe which has been "burnt" in coloring, the top of the bowl being the natural color, while the lower part and stem are a rich brown. Is there any efficient receipt for bringing the whole pipe back to its natural color, so that it can be recolored again? A. Meerschaum pipes are sometimes heated in melted beeswax for ten minutes. It is better to send it to a reliable dealer for treatment.

(161) F. B. C. asks: Could I charge a storage battery of one cell by means of the electricity generated by a 16 in. belt, moving vertically (length about 100 ft.), from which I now, by means of wiring, light 105 gas jets, ordinary tips, one at a time? Spark from ¾ in. to 1 in. according to condition of weather. Or if not, how could I intensify it (the current)? A. You ask for an impossibility in a practical sense. The current has such high potential and so little quantity that it would not work for the purpose named.

(162) W. H. D. asks (1) for a good recipe, whereby he could clean thoroughly oil paintings, and restore them to their original colors. A. No such receipt can be given. If the paintings are valuable, they should be put in the hands of a professional restorer, who will adapt his methods to the requirements of the case. 2. To what purpose could large quantities of

oyster shells be put? A. They could be used in making shell lime for gas works, or for road making. A shell road is equal to a macadamized road in quality. New Orleans is celebrated for its shell roads.

(163) F. C. H. asks: What is the reason that when I use a microphone in the circuit with a Bell telephone receiver, and when the microphone is spoken to, that each sound of the voice is accompanied with a scraping sound audible in the receiver? And will you please tell me how to remedy it? A. The microphone is badly adjusted, and probably breaks the circuit. The carbon electrodes should be held more tightly pressed together, or their surfaces may be deficient in finish.

(164) C. E. B. writes: I am desirous of making a model composed of rubber, the same as the large rubber bands. Will you be kind enough to tell me how I can mould it? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 555, which we can send you for ten cents, for process of moulding India rubber type. This will probably cover your needs.

(165) W. A. H. asks: Will condensed air create a vacuum in a siphon or injector the same as steam does? And do you think an air siphon could be built, supposing the air to be under 30 to 35 pounds pressure? A. It will in the jet siphon; the injector depends upon the condensation of steam, and will work with air as in steam blowers. An air siphon could readily be built to work as described. For general descriptions of pneumatic machinery, we refer you to our SUPPLEMENT catalogue and indices of SCIENTIFIC AMERICAN.

(166) J. B. asks for the constituent parts of the transfer ink as used in the various autocopyist systems. A. Aniline colors mixed with water and glycerine or with vaseline are the general constituents of such inks.

(167) J. S. writes: Please give me a receipt for mucilage. A. Dissolve gum arabic in water, until thick enough to suit the requirements.

(168) C. S., J. H. C., and others.—For printer's rollers use 10½ lb. best glue; 2½ gallons black molasses, or honey; 1 lb. India rubber, dissolved in alcohol; 2 oz. Venice turpentine; 12 oz. glycerine; 4 oz. vinegar. This formula is given for the mysterious "black composition, so durable and elastic, and known to but very few persons until recently. *Purified rubber only* to be used. The old home recipe is 2 lb. glue, soaked overnight, to one gallon of New Orleans molasses. In cold weather more molasses is used, but the press room should be kept at about 70°. The mould should be of iron, perfectly smooth and oiled inside; never heard of a wood mould being used.

Enquiries to be Answered.

The following enquiries have been sent in by some of our subscribers, and doubtless others of our readers will take pleasure in answering them. The *number* of the enquiry should head the reply.

(169) Will you please let me know if there is any way to keep blue checked cotton, such as is used for overalls, from fading and shrinking? I have a roll which turns brown and shrinks about three inches when made up.—F. W. M.

(170) 1. How can I cut and polish stones and minerals? 2. What tools and materials are used? 3. What size wire on the field magnets and armature should I use in making a dynamo twice the size of the one described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 600?—O. I. F.

(171) Could you give me a receipt for making a walnut stain (water) and an ebony acid stain? Is there a walnut alcohol stain?—T. H. F.

(172) Rule for calculating a safety valve, not a complicated rule, but a very simple rule that a man with a limited education can understand, and an example explaining. Also a receipt for removing zinc and white lead paint from iron.—A. D. C.

(173) I would like to get some pointers in regard to making gaskets for hydraulic pumps. We use a hydraulic pump which has to lift a four hundred ton pressure on a 13 inch ram. Gaskets are continually giving out on connections and plungers, and valves sometimes fail to act. Please give me a rule for speeding up machinery and squaring up diameters or find out the square inches in a given space.—J. A. B.

(174) 1. How can you find out the horse power of a boiler? 2. Are feed pipes liable to burst quicker in front of a boiler than behind?—D. C.

(175) Please inform me the construction principle and operation of the air brake used on cars.—C. S. B.

(176) 1. What number of horse power will be required to generate a sufficient amount of electricity to run fifty arc lights? 2. What will the probable cost be for a plant of sufficient power to run fifty arc lights?—H. C.

(177) Please give me a receipt for cleaning the white keys of a piano that have turned yellow, and what will keep them white? Also a receipt to make black varnish, that which the tinsmiths use on stove pipe, which gives it a nice gloss.—G. H. A.

(178) Please inform me how to color clothing from a light into a dark blue, and also what kind of an eyeglass would you recommend to guard against snowblindness?—H. M.

(179) How can I make a porous brick that will absorb kerosene oil? I want to make a firekindler that will kindle wood or coal. Also a brick that could be used as a fuel? There is a fire clay here. Could I make it of that? Please give me a receipt for a good top dressing for carriage tops, and oblige.—C. L. S.

(180) I have some abelone and other sea shells just as they came from the water. I write to enquire the best method of removing the rough outside coating without injuring the shells.—W. B. D.

(181) Can you inform me of a good receipt for making black bicycle enamel, and oblige.—O. K.

(182) Can you tell me how to make phosphorized oil?—A Student.

(183) Could you please give a receipt for taking the green boil off gold that is there after it has been annealed and boiled out in nitric acid pickle? If you could, you would greatly oblige your subscriber.—W. J. S.

(184) I have a small telescope with a two inch object glass, mounted equatorially, with clock works to follow a celestial object in its daily motion, and camera attachment. I have been making efforts to take a photograph of the moon and find that I can get a very good impression one and one-half inches in diameter on the sensitive plate by exposing it two minutes. The image, however, lacks definition, and I am led to believe that the trouble lies in the eye piece of the telescope, which is a simple convex lens of one inch focus. (The focus of the object glass is 36 inches.) If you will kindly give me some suggestions through the columns of your valuable paper, with regard to the style and power of the eye piece, etc., to be used for obtaining a good picture, they will be thankfully received by C. V. A.—Could the size of the picture be increased to good advantage?—V.

(185) We have a hot air furnace and we are not able to get the heat into any room in the direction the wind blows, when in north room facing north cannot get the heat to come in the room, and so with every room facing the wind from different quarters, in a good brick house and the cold air draught taken from the hall way or from outside. Can or is there any remedy, or what are the causes?—C. H. S.

(186) I am thinking of studying, after working hours, some works on electricity. I want a knowledge of the electric light and motors. Could I get a practical knowledge of either or both without teacher? If you think I can, please give price and title of book or books. I know nothing at all about the subject at present.—E. F. C.

(187) How do ocean steamers like the Etruria get their boiler feed water and water for culinary purposes? In other words, do they use sea water in their boilers? I thought they filled up their boilers with fresh water before sailing and used sea water to keep up supply while at sea, using for culinary purposes fresh water carried in tanks from either side. A friend says I am wrong, as they use distilled water for boilers and cooking, from their condensers, but I would not think that that source of supply would be sufficient for both, should think that they would want a separate condenser from that in connection with exhaust.—W. S. B.

(188) What will cement hard and soft rubber together so as to be proof aginst the action of all acids save those that act upon the rubber?—J. D. B.

(189) Do you know any means to put in order a watch that has been magnetized by a dynamo electric machine, or any solution to prevent it from being magnetized?—H. M.

(190) How many 50 volt lamps would the eight light dynamo of SCIENTIFIC AMERICAN SUPPLEMENT, No. 600, run, if the dynamo were run by a one horse power, 11 inch, rotary water motor? How many with a water motor 6 inches in diameter? How many 25 volt lamps? The dynamo, in all cases being shunt wound.—L. D. M.

(191) What is the best mode to restore oil paintings that are cracked, and the best mixture to add to gold bronze for picture frames? Also are there any well defined principles for a belief.—F. A. L. S.

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the numbers therein given:

(1) Hardening Soles of Shoes.—G. W. (1) in Notes and Queries in a recent number of SCIENTIFIC AMERICAN, asks for a receipt for hardening soles of shoes, and you reply that there is nothing practical for such purpose except nails. Stockholm tar rubbed on the soles of shoes hardens the leather materially, renders it impervious to water, and makes it wear much longer than leather not thus treated.—W. M. S.

(16) Grafting Wax.—A good grafting wax can be made by melting together 50 lb. resin, 10 lb. beeswax, and 1 gallon raw linseed oil. As soon as the resin and wax are melted, dip a pint at a time into a bucket of cold water, keeping it away from the bucket with a stick. As soon as it is cool enough, stretch with slightly greased hands. If the wax is to be used in very warm weather, a little less oil and beeswax will be better.—A. T. C.

(21) Utilizing Leather Scraps.—In a former issue of your SCIENTIFIC AMERICAN, one of your readers asks for a receipt to utilize leather scraps. The most establishments first clean and then soak them in a 1 per cent solution of sulphuric acid until soft, and press them into blocks and dry by steam. Now add 1 lb. glycerine to 100 lb. and press into sheets, to be used in soles of boots and shoes.

(27) Bell Telephones, Battery, etc.—1. No change is necessary in the telephones. 2. About ½ oz No. 36 silk-insulated copper wire. 3. A single contact transmitter is best, and the use of an induction coil is a great improvement. Put transmitter battery and coil in a local circuit and connect the line wire, receiver terminals, secondary wire of coil and ground together. A transmitter with horizontal diaphragm, having a carbon button in the center, and a small carbon pencil, about ⅜ in. × 1 in., resting vertically upon the button, is about as easily made and as sensitive as any of the ordinary transmitters. It requires no adjustment whatever. 4. See back numbers of SCIENTIFIC AMERICAN SUPPLEMENT. 5. If carbons are dry and the lead runs at a low heat, there will be no injury. Type metal would be preferable. 6. A sealed potash cell works very well on bell and gas lighting circuits. A spark coil is necessary for the latter.—W. A. R.

(27) Lead Connections for Carbons.—Will you permit me space in your paper to say in answer to late inquiry that lead may be successfully used for head caps to carbon heaters, and from a long experience I know it will bind tight enough to make good contact. I have cast lead caps on pretty nearly all forms of carbons, rods, plates, cylinders of rods, plates of rods, etc., using a wooden mould into which to pour the lead. If heated hot enough to run freely, so as to not be chilled by the cold carbons, it will shrink so as to be easily lifted from the mould, and so as to bind so tight on to the carbons as to defy all attempts to loosen it or pull it off. Those who wish to construct batteries from electric light pencils may be glad to know that many of these pencils are defective in manufacture and are rejected on inspection. These defective pencils are not plated, but thrown aside to be ground up and recast or remoulded. They will serve as well as the best for battery use. I bought five hundred full length pencils (12 inches × ¼ inch) at one time, for two cents a piece, and have used them to construct all kinds of batteries. By getting these naked carbons, the trouble and expense of eating off the copper from those that are plated is avoided, and just as good results obtained. Of course if one can get the refuse pencils from an electric light station for little or nothing, it would pay to use them with the attendant trouble of eating off the copper. But many may not be able to do this, and such can get these condemned pencils at much less cost than new pencils. I prefer the lead cap on the bare carbon as much less liable to damage them, copper plating and then casting on type metal, from any possible leaking of acid through the paraffine in the tips.—C. D. PARKHURST.

(34) Capacity of Wire.—1. The number of volts a wire is required to carry does not affect the size of the conductor. That is determined by the number of amperes. The rule is, allow 800 circular mills per ampere of current carried. The circular mill is the square of the diameter of the conductor in thousandths of an inch; 800 circular mills per ampere for 120 amperes = 96,000 circular mills. Diameter of No. 0 (B. and S. gauge) is 0·32495. As thousandths of an inch 324·95 × 324·95 = 105,502 circular mills. Therefore No. 0 wire should be used. 2. The dynamo you examined was probably a Gramme machine, in which the current divides, half going through one side of the armature, and half through the other, so that the wire need not be as large as the line. 3. In general, to increase E. M. F., wind armature with more and finer wire; to increase amperes, wind with heavier wire. The amount of saturation of armature core has a great deal to do with it. 4. Yes. [A wire cannot be said "carry volts." Between contiguous molecules there is no difference of potential, although a wire may be carrying a current due to many thousand volts difference of potential as referred to its terminals. —ED.]

(35) Bleaching and Polishing Ivory.—Slake some lime and put your ivory in the clear water decanted from the residue and boil until it looks white; to polish put in lathe, use pumice stone, and wind up with chamois and a very little olive oil. Make the leather warm. [It is risky to boil large articles of ivory, as it tends to split them.—ED.]

(41) Burning Tree Stumps.—Bore a 1 in. hole 18 in. deep in center of stump, put in 1 oz. saltpeter, then fill hole nearly full of water, then plug up tight; this is done in the fall and spring. Take out the plug, pour in ½ gill of kerosene and set on fire, and it will burn out to the very extreme ends.—C. T.

(41) Burning Stumps; Coloring Maple Sirups.—1. Bore a 2 in. hole slanting in the stump, fill ⅔ full with saltpeter, fill up with water, and cork. After two or three months, pour a little coal oil on the stump and set on fire. 2. Add a sufficient quantity of diluted caramel (burnt sugar).—W. A. R.

(43) Rifle Sights.—If a rifle having globe and peep sights is screwed firmly into a vise and fired at targets, the ball will be found to strike below the line of sight for a distance varying from 50 to 100 feet, if the rifle is sighted for an exact center at say 60 yards. In an ordinary open-sighted rifle, an expert shot will instinctively draw a fine or coarse "bead" as may be necessary to make the ball "drive the center."—W. A. R.

(52) W. D. R.—You can only clean iron wire by pickling in a bath of hydrochloric acid 1 part, water 3 parts. Then run it through a draw plate in oil —or if not convenient, pass the wire through a series of leather wheels charged with flour emery and oil; the wheels so arranged and grooved as to touch all sides of the wire.—For Galvanizing.—After pickling as above, pass the wire through a trough of muriate of zinc and ammonia, and immediately through a bath of melted tin or zinc, which, if properly done, will bring out the wire clean and smooth. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 34, for illustrated description of method of galvanizing iron wire.

(53) O. K.—You will find in "Techno-Chemical Receipt Book," which you can buy for $2, an article on enameling bricks, p. 415, and on the manufacture of colored enamels, p. 117. Also enamels and glazes for pottery, pp. 221 to 224, Spons' Receipts, 3d series, $2. Also Davis on the manufacture of bricks, tiles, and terra cotta, $5. Also SCIENTIFIC AMERICAN SUPPLEMENT, No. 387, enameling pottery, with receipts for various colors. Also SCIENTIFIC AMERICAN SUPPLEMENT, No. 402, encaustic tiles, how made.

(54) R. T. F.—1. You can buy thin sheet steel through the hardware trade that is suitable for springs. Cut with a tinsmith's shears, file and drill. 2. To stamp your name on velvet in gold leaf. Sprinkle the space that the name is to cover with pulverized gamboge through a thin muslin bag or piece of silk tied over a small box. Lay a piece of gold leaf of the proper size on the spot. Use printer's type properly set in a frame. Heat the type to about the temperature of boiling water, and press upon the gold leaf for a moment. When cold, brush off the gold leaf and excess of powdered gamboge with a fine brush. Try this on a separate piece of velvet, as you may need a little experience.

(53) Glazing Brick.—The brick is dipped in a transparent colored glaze usually formed, besides the coloring oxides, of: Oxide of lead 40 to 50 per cent, silicious sand 30 to 40 per cent, salt 0 to 12 per cent; flux in an oven. Coloring: Red—Iron, iron sulphate, copper (oxidule), ocher. Yellow—Antimony, with sulphate or potash, titanium, chromate of lead, chromate of barytes. Green—Copper, chrome with cobalt. White—White clay, powdered soapstone, 5 per cent tin oxide. The coloring oxides are introduced in quantities usually of 5 to 10 per cent. They act as fluxes, and the composition of the body must be altered in some cases to counteract this.—D. A. S.

(55) Nozzle Streams.—Rubber hose, 100 feet, 60 pounds at hydrant: 1 inch smooth nozzle, 125 feet horizontal, 98 feet high; 1 inch ring nozzle, 125 feet horizontal, 95 feet high; 1¼ inch smooth nozzle, 117 feet horizontal, 81 feet high; 1¼ ring nozzle, 122 feet horizontal, 89 feet high.—J. B. [We can furnish by mail a work on fire streams for $1.50.

(55) W. H. G.—With full length of 50 or 100 feet of hose, the 1 in. nozzle will throw the highest. Friction of the water in the hose interferes with the final pressure at the nozzle. The velocity of the water in the hose having the 1¼ in. nozzle will be more than 50 per cent greater than in the hose having the 1 in. nozzle. This lessens the pressure and makes the difference in favor of the 1 in. nozzle.

☞ Books or other publications referred to above can, in most cases, be promptly obtained through the SCIENTIFIC AMERICAN office, Munn & Co., 361 Broadway, New York.

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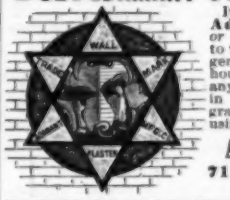

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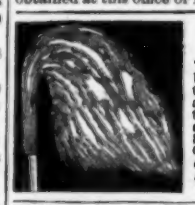

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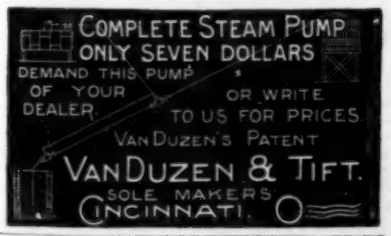

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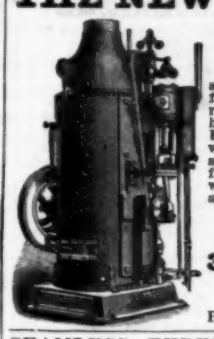

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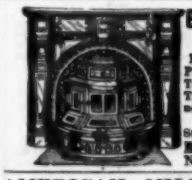

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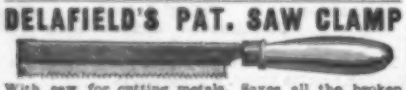

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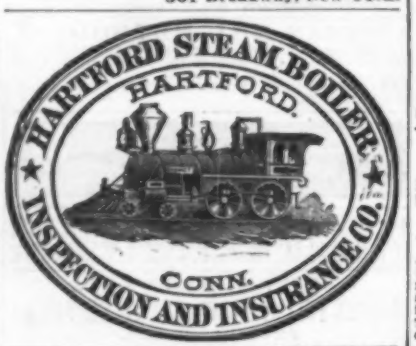

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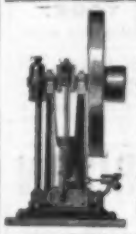

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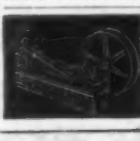

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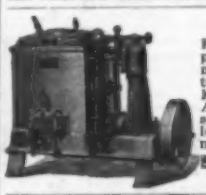

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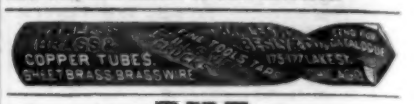

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